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P.O.Box: 37444 Tel: 00967 1 675567 Fax:00967 1 675885
E-Mail: magazine@andalusuniv.net
web site: www.andalusuniv.net

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Detection of anti-Hepatitis B core antibodies among Hepatitis B surface antigen negative blood donors in Sana’a city, Yemen

د. خالد عبد الكريم المؤيد
قسم الأحياء الدقيقة الطبية، كلية الطب والعلوم الصحية
جامعة صنعاء، صنعاء – اليمن

د. أحمد محمد الحداد
قسم العلوم الطبية الأساسية، كلية الطب والعلوم الصحية
جامعة حضرموت للعلوم والتكنولوجيا، المكلا – اليمن

د. وليد عبد الواسع سلام
بنك الدم بقسم المختبر
هيئة مستشفى الثورة العام، صنعاء – اليمن
Detection of anti Hepatitis B core antibodies among Hepatitis B surface antigen negative blood donors in Sana’a city, Yemen

Abstract

Hepatitis B is still a serious global infectious disease that remains a high risk for patients requiring blood transfusions, despite the introduction of appropriate methods for diagnosis of the causative virus in blood banks, thus this cross-sectional study aimed to estimate anti-HBc (IgM and IgG) antibodies in blood donors who were HBsAg negative, to determine HBV-DNA among the positive anti-HBc blood donors and finally to study the association of positive anti-HBc Abs donors with the predisposing factors contributing for HBV transmission in Sana’a city, Yemen.

This study included 700 Yemeni male blood donors who came for blood donation to the National Center for Blood Transfusion and Research in Sana’a city during a one year period (January - December 2010). Their age ranged from < 20 years to ≥ 40 years old with a mean age of 38 years and a standard deviation (SD) of 6.9 years. Blood samples and information data were collected from each subject recruited in the study. Serum was separated and tested for anti-HBc antibodies and HBV-DNA by an automated ELISA and RT-PCR method. Data were analyzed by SPSS (version 15) for statistical significance.

In this study, the prevalence of anti-HBc-IgG among the studied subjects was 9%, whereas the prevalence of anti-HBc-IgM was zero. HBV-DNA was detected in 4.8% of these positive anti-HBc-IgG subjects. This study showed that blood donors with positive anti-HBc-IgG had a significant association with increased age. The main predisposing factors that had a significant association with positive anti-HBc-IgG subjects were blood transfusion, history of jaundice and family history for hepatitis.

It can be concluded from this study that there was a relatively high positive percentage for both anti-HBc-IgG and HBV-DNA among subjects who were HBs Ag negative. Increased age, previous blood transfusions, history of jaundice and family history of hepatitis were the main predisposing factors associated with positive anti-HBc-IgG subjects.
**Introduction**

Hepatitis B virus (HBV) is the most common cause of serious liver infection in the world. It is estimated that worldwide more than two billion people have been infected by HBV and 350 million people have chronic infection. Transfusion transmitted HBV has always been a dreaded disease, which has an unholy reputation of being transmitted fairly often among donated blood. The safety of blood and blood products are one of the major issues in the area of transfusion medicine.

It has been demonstrated that some hepatitis B surface antigen (HBs Ag) negative individuals and those positive for hepatitis B core antibody (anti-HBc) continue to replicate HBV. Thus the absence of HBs Ag in the blood of apparently healthy individuals may not be enough to ensure lack of circulating HBV and blood that containing anti-HBc with or without detectable presence of HBs antibody might be infectious; therefore, routine blood donor screening for anti-HBc has been implemented in some countries, resulting in a decrease in the risk of post-transfusion HBV infection.

HBV infection is one of the major health problems in Yemen, thus to increase the bloodsafety screening for anti-HBc antibodies must be introduced among blood donors to reduce HBV transmission.

In a previous study, the prevalence of HBs Ag among Yemeni blood donors was 6.7%, whereas the prevalence of anti-HBc antibody was 17.4%.

In blood donors the incidence of transfusion-related HBV has significantly decreased due to routine screening for HBs Ag. Post transfusion HBV depends on several factors like prevalence and donor testing strategies. In low prevalence areas it is estimated to be one to four per million blood components transfused. In Yemen, the prevalence of anti-HBc-IgG among blood donors who were HBs Ag negative was 16.5%.

In Saudi Arabia, Iran and the most parts of Middle East region, the prevalence of anti-HBc-IgG was documented with varies percentages among blood donors who were HBs Ag negative. HBV-DNA was also detected in positive anti-HBc blood donors who were HBs Ag negative as reported in Egypt, India and Iran, but with different percentages.
There are no published data about this issue, although its importance in Yemen, therefore the aims of this study was to estimate anti-HBc (IgM and IgG) in blood donors who were HBs Ag negative, to determine HBV-DNA among the positive anti-HBc blood donors and finally to study the association of positive anti-HBc donors with the predisposing factors contracting for HBV transmission in Sana'a city, Yemen.

**Materials and Methods**

This cross sectional study was carried out during a period of one year (January to December 2010). The study group consists of 700 male blood donors who denoted blood at the National Center for Blood Transfusion and Research (NCBTR) in Sana'a city. Blood samples were collected from these blood donors in plane tubes (3 ml) from each donor. Blood in plane tube allowed to clotting then the sera were separated and kept in a deep freeze at -70o C. All collected samples were tested for HBs Ag, anti-HBc total, anti-HBc-IgM and HBV-DNA at the NCBTR in Sana’a city. The sera were tested for HBs Ag, anti-HBc-total and anti-HBc-IgM by an automated ELISA method using the Elecsys device system (Roche Diagnostics, Germany). All subjects who had negative result for HBs Ag as confirmatory test were selected and tested for anti-HBc-total and anti-HBc-IgM. The positive anti-HBc samples were then analyzed for HBV-DNA by a RT-PCR technique using the COBAS TaqMan 48 analyzer (Roche Diagnostics, Germany) for automated amplification and detection of HBV-DNA in human serum by the high pure system viral nucleic acid kit for manual specimen preparation. The collected data from each subject were analyzed using a statistical package of social science program (SPSS, version 15) and the probability value (p) of <0.05 was considered as statistically significant.
**Results:**

This study included 700 male blood donors who were HBs Ag negative by an ELISA technique performed at the NCBTR in Sana’a city. Their age ranged from < 20 years to ≥ 40 years old with a mean age of 38 years and a standard deviation (SD) of 6.9 years. Out of the total studied subjects, 63 subjects were only positive for anti-HBc-IgG with a percentage of 9% and the rest 637 subjects were negative for these antibodies. HBV-DNA was detected in 3 of the 63 positive anti-HBc-IgG subjects with a percentage of 4.8%. The detailed results of this study are presented in the following tables:

**Table (1):** Distribution of the total studied subjects according to the different serological markers

<table>
<thead>
<tr>
<th>Serological Markers</th>
<th>Positive</th>
<th>Negative</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>Total anti-HBc</td>
<td>63</td>
<td>9</td>
<td>637</td>
</tr>
<tr>
<td>Anti-HBc-IgG</td>
<td>63</td>
<td>9</td>
<td>637</td>
</tr>
<tr>
<td>Anti-HBc-IgM</td>
<td>0</td>
<td>0</td>
<td>700</td>
</tr>
</tbody>
</table>

Table 1 shows the distribution of the total studied subjects according to the different serological markers. Out of the total 700 studied subjects, all were negative for anti-HBc-IgM, only 63 subjects were positive for anti-HBc-IgG and at the same time for the total anti-HBc with a percentage of 9% for each.

**Table (2):** Distribution of HBV-DNA level among positive anti-HBc-IgG subjects

<table>
<thead>
<tr>
<th>HBV-DNA</th>
<th>Positive anti-HBc-IgG</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
</tr>
<tr>
<td>Detected</td>
<td>3</td>
</tr>
<tr>
<td>Undetected</td>
<td>60</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
</tr>
</tbody>
</table>

Table 2 shows the distribution of HBV-DNA level among positive anti-HBc-IgG subjects. HBV-DNA was detected among 3 of 63 positive anti-HBc-IgG subjects with a percentage of 4.8%.
Table (3): Distribution of positive anti-HBc-IgG subjects according to their age

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Anti-HBc-IgG (n=63)</th>
<th>Total (n=700)</th>
<th>(\chi^2)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>&lt; 20</td>
<td>4</td>
<td>6.2</td>
<td>65</td>
<td>9.3</td>
</tr>
<tr>
<td>20-29</td>
<td>25</td>
<td>6.7</td>
<td>375</td>
<td>53.6</td>
</tr>
<tr>
<td>30-39</td>
<td>25</td>
<td>12.5</td>
<td>201</td>
<td>28.7</td>
</tr>
<tr>
<td>≥ 40</td>
<td>9</td>
<td>15.3</td>
<td>59</td>
<td>8.4</td>
</tr>
</tbody>
</table>

\(\chi^2 \geq 3.84, p < 0.05\) (significant)

Table 3 shows the distribution of positive anti-HBc-IgG subjects according to the age groups. The highest prevalence of positive anti-HBc-IgG occurred in the age group ≥ 40 years which was 15.3% and the lowest prevalence of anti-HBc-IgG was in the age group < 20 with 6.2%. This result was statistically significant with values of \(\chi^2 = 8.85, p < 0.031\).

Table (4): The prevalence and relative risk of positive anti-HBc-IgG subjects according to the predisposing factors

<table>
<thead>
<tr>
<th>Predisposing Factors</th>
<th>Anti-HBc-IgG (n=63)</th>
<th>RR</th>
<th>CI</th>
<th>(\chi^2)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgical Operation (n=34)</td>
<td>3</td>
<td>8.8</td>
<td>0.98</td>
<td>0.32-2.96</td>
<td>0.001</td>
</tr>
<tr>
<td>Dental/ Clinic Visit (n=116)</td>
<td>10</td>
<td>8.6</td>
<td>0.95</td>
<td>0.50-1.81</td>
<td>0.024</td>
</tr>
<tr>
<td>Cupping(n=17)</td>
<td>2</td>
<td>11.8</td>
<td>1.32</td>
<td>0.35-4.95</td>
<td>0.163</td>
</tr>
<tr>
<td>History of jaundice (n=21)</td>
<td>7</td>
<td>33.3</td>
<td>4.04</td>
<td>2.10-7.78</td>
<td>15.66</td>
</tr>
<tr>
<td>Blood transfusion (n=30)</td>
<td>11</td>
<td>36.7</td>
<td>4.72</td>
<td>2.76-8.10</td>
<td>29.29</td>
</tr>
<tr>
<td>Accidence (n=14)</td>
<td>1</td>
<td>7.1</td>
<td>0.79</td>
<td>0.12-5.30</td>
<td>0.060</td>
</tr>
<tr>
<td>Shared Shaving bald (n=49)</td>
<td>6</td>
<td>12.2</td>
<td>1.40</td>
<td>0.64-3.08</td>
<td>0.677</td>
</tr>
<tr>
<td>Traveling Abroad (n=25)</td>
<td>2</td>
<td>8.0</td>
<td>0.89</td>
<td>0.23-3.42</td>
<td>0.032</td>
</tr>
<tr>
<td>Intravenous drug abuse (n=32)</td>
<td>4</td>
<td>12.5</td>
<td>1.42</td>
<td>0.55-3.65</td>
<td>0.502</td>
</tr>
<tr>
<td>Family history for hepatitis (n=53)</td>
<td>10</td>
<td>31.3</td>
<td>2.30</td>
<td>1.24-4.26</td>
<td>6.82</td>
</tr>
</tbody>
</table>

\(\chi^2 \geq 3.84, p < 0.05\) (significant), RR > 1 (at risk).

Table 4 summarizes the prevalence and relative risk of positive anti-HBc-IgG subjects according to the predisposing factors. The main risk factors associated with positive anti-HBc-IgG were blood transfusion, history of jaundice and family history for hepatitis with percentages of 36.7%, 33.3%
and 31.1% respectively. These results were statistically significant with
values of $\chi^2 = 29.29$, $p<0.0001$ for blood transfusion, $\chi^2 = 15.67$, $p<0.0001$
and for history of jaundice and finally $\chi^2 = 20.27$, $p<0.0001$ for family
history for hepatitis. As regard the relative risk (RR), blood transfusion was
nearly 5 times, history of jaundice was 4 times and finally family history for
hepatitis was nearly 2 times more at risk for each than other predisposing
factors.

Discussion

Hepatitis B is still a serious global infectious disease that remains a high
risk for patients requiring blood transfusions, despite the introduction of
appropriate methods for diagnosis of the causative virus in blood banks.
In this study, out of the 700 enrolled subjects who were negative for HBs
Ag, anti-HBc-IgG was detected in 9% of them as shown in tables (1). This
result was nearly similar to other studies performed in Brazil (8.7%)16, India
(8.4%)17, Egypt (7.8%)14 and finally Iran (8%).13 On the other hand, higher
results were reported in Saudi Arabia (16.4%)18, Oman (20.5%)19, Pakistan
(17.3%)20, Turkey (21.4%)21, Yemen (16.5%)12 and finally India
(19.8%).22
In addition, the highest prevalence at all was reported 43.4 % in Indonesia
(23). Lower results were reported in Iran (2.1%), Italy (4.8%), and finally in
China (4.9%).24-26 These disagreeable findings could be mainly explained
by the result of regional differences in the prevalence of HBV infection.
In the present study, out of the 700 enrolled subjects who were negative for
HBs Ag, all were anti-HBc-IgM negative as shown in tables (1). Result of
this study was in agreement with a study conducted in Yemen previously.12
In contrast, the present study result was lower than that reported in India and
Nigeria, which showed a percentage for anti-HBc-IgM of 0.4% and 5.4%
respectively.5,27 This difference could be explained by the difference in
sample size, geographical distribution and/or personal behavior.
In this study, HBV-DNA was detected among 3 of 63 (4.8%) positive anti-
HBc subjects as shown in table (2). This result was to somehow corroborated
with other studies reported in Italy (4.9%)25, Egypt (6.3%)14, India
(7.5%)22 and finally in Indonesia (8.1%)23, However, our result was higher
than that of another study reported by Allain and co-workers (2003) in
Ghana (0.5%).28 In contrast, this same result was lower than that reported in
Iran (30%) and in India (30%).13,15 Other studies performed in UK and
Greece mentioned undetected HBV-DNA among positive anti-HBc blood
donors.29,30 This dissimilarity in HBV-DNA detection among positive anti-
HBc blood donors could be attributed by the difference in the endemicity
area of hepatitis B infection and the difference in the sensitivity and accuracy of PCR techniques.

The prevalence of positive anti-HBc-IgG showed a statistical significance with increased age ($\chi^2 = 8.85$, $p = 0.031$), where the highest prevalence was found among the subjects aged $\geq 40$ years as shown in tables (3), this similar observation was reported by Panhotra and co-workers (2005)31and El-Beltagy and co-workers (2007) in Saudi Arabia32, who reported that the highest prevalent rate was found among the donor population aged $\geq 40$ years. In addition, Mudawi and co-workers (2007) in Sudan also mentioned that the highest prevalent rate was noted among the donor population aged $\geq 50$ years.33 Moreover, additional studies in Ghana and Iran reported that also the highest prevalence of HBV infection in general was found in the age groups older than 40 years.28,34 The reason for this increased prevalent rate in the age group $\geq 40$ years may be related to a past infection before introducing of national vaccination program or due to that older persons probably have a longer disease exposure, duration and may practicing many inappropriate and unacceptable habits such as non-hygenic shared shaving tool or out marriage intercourse.31,35,36

The main predisposing factors for positive anti-HBc-IgG among studied subjects were blood transfusion, history of jaundice and family history for hepatitis, which showed a high statistical significance as seen in table (4). Anti-HBc-IgG were positive in 36.7% of subjects with pervious blood transfusion comparing with those without pervious blood transfusion. This result was higher than that reported in Sudan and Brazil, in which the prevalence of anti-HBc-IgG were 5.1% and 26.7% respectively.33,36 On the other hand, the above mentioned result agreed with a pervious study conducted in Yemen by Al-Kyal12, which was also statistically significant. In contrast, the present result disagreed with a study performed in Iran by Merat and co-workers (2009), in which the prevalence of anti-HBc-IgG was 17% in pervious blood transfusion subjects and this result was not statistically significant.37 This difference could be attributed to the lack of specific and/or inadequate diagnostic tests in blood banks for screening Yemeni donors. Positive anti-HBc-IgG in subjects with family history for hepatitis showed 31.3% and was statistically significant as shown in table (4). This result agreed with two studies conducted in Saudi Arabia and Iran, which reported also a positive result for anti-HBc-IgG among donors with family history of hepatitis.32, 37 Positive anti-HBc-IgG among donors with history of jaundice was 33.3% as mentioned in table (4). Most studies exclude the donors with history of jaundice as a part of the international guideline of blood donation.38
References


3) 3-Ogbu O, Uneke C. Hepatitis B virus and blood transfusion safety in sub-Saharan Africa. The Internet Journal of Infectious Diseases, 2009; 7(2).


تحديد أضداد المستضد البّي بين متبرعي الدم السالبين للمستضد السطحي لفيروس التهاب الكبد اليمني بمدينة صنعاء-اليمن

المختصر العربي:
لا يزال التهاب الكبد الفيروسي البالي مرضاً معدياً عالياً خطيراً ومصدر عدو متكرر لماضي. الذين يعانون من نقل الدم بشكل دوري بالرغم من تقدم الطرق العملية الملائمة لتشخيص الفيروس السبب. هدفت هذه الدراسة إلى تحديد أضداد المستضد البّي (IgG + IgM) لفيروس التهاب الكبد البالي بين متبرعي الدم الذين كانوا سالبين للمستضد السطحي لذئل الفيروس وكان هذا تحديد الحمض النووي DNA للفيروس بين الحالات الإيجابية لأضداد المستضد البّي.

تضمنت هذه الدراسة الفحص تجريبي لـ 1000 متبرع بالدم من الذكور والمترددين على المركز الوطني لنقل الدم وأبحاثه بمدينة صنعاء خلال الفترة من يناير إلى ديسمبر 2010. و تراوحت أعمارهم من أقل من 20 سنة إلى ما يساوي أو أكثر من 40 سنة مع متوسط عمر يبلغ 28 سنة وانحراف معياري ± 6.9.

تم جمع بيانات عينات دم من كل متبرع مدرج في الدراسة. ثم تم قضي الجمل منها واختبار لأضداد المستضد البّي بواسطة طريقة مقايسة المثّر المناعي المترّبط بالإيدز ومن ثم الحمض النووي للحالات الإيجابية للأضداد فقط باستخدام طريقة تفاعل سلسلة البوليميراز. أما البيانات فقد تم تحليلها إحصائيًا باستخدام برنامج الحزمة الإحصائية (SPSS).

تم تحديد أضداد المستضد البّي IgG البالي في 94% من إجمالي الحالات بينما كانت أضداد المستضد IgM البالي سالبة. أما ما يخص الحمض النووي الفيروسي فقد تم تحديده في 3 عينات DNA محلية. أما ما يخص الحمض النووي الفيروسي IgM البالي في 8% من إجمالي عينة الإيجابية لأضداد المستضد البالي، فينطبق هذا القياس على 41.8% كما بنيت هذه الدراسة أن هناك علاقة ذات دلالة إحصائية بين متبرعي الدم الإيجابيين لأضداد المستضد البالي وتقدم العمر لديهم. وكانت عوامل الخطر الرئيسي ذات دلالة إحصائية عند المبترين الإيجابيين تلك الأضداد هي نقل الدم سابقاً والتاريخ المرضي لليرقان والتاريخ العائلي لالتهاب الكبد البالي.

يُستنتج من هذه الدراسة أن هناك نسبة أضداد عالية للمستضد البّي في المتبرعين DNA اليمنيين المتبرعين بالدم وكذلك نسبة عالية للحمض النووي الفيروسي الإيجابيين لذئل الأضداد والسلالين للمستضد السطحي لفيروس التهاب الكبد البالي مما يؤكد عدم سلامة مدى هؤلاء المتبرعين انتقال الفيروس إلى المستقبلين. تنتهي هذه الدراسة أن عوامل الخطر الرئيسي المترتبة بتكرار الدم الإيجابيين لهذه الأضداد هي تقدم العمر ونقل الدم سابقاً والتاريخ المرضي لليرقان والتاريخ العائلي لالتهاب الكبد البالي.

المستند: (SPSS)
Family Planning Methods knowledge, attitude and practice among Males and Females in Reproductive age in AL-Mukalla District

Nawal S Banafa; MBBS MD
Assistant Professor Of community medicine
Department of Basic medical sciences
College of Nursing- Hadhramout University
Tel: 00967 770768484 /00967 736131965 - PO Box: 50595
Email: nawalsaeed1998@yahoo.com

Samar S Banafa; MBBS
Ibn Sina hospital
Ministry of Health & Population (MOHP)

Rasha S Bazeghifan ;MBBS
Zahra A Ba-Azeem;MBBS

Family medicine department
Ministry of Health &population(MOHP) –Hadhramout office.

Riman S Barhian ;MBBS
Adba M Al Tarbi ; MBBS

AL-Mukalla hospital for maternity and childhood
Ministry of Health &population(MOHP) –Hadhramout office.
Family Planning Methods knowledge, attitude and practice among Males and Females in Reproductive age in AL-Mukalla District

INTRODUCTION

Hadramout considered the largest governorate in the Republic of Yemen which is about 36% of the whole area of Yemen. The governorate has been divided in 2 parts, the first cover the directorates situated at the coastal strip and heights, the other part contain the directorates which stretch at length of the wadi and desert.\(^1\). Each year, roughly 13,000 women in middle east and North Africa (MENA) region die of complication related to pregnancy and childbirth, although the maternal mortality ratio vary greatly by country three out of five maternal death in the region occur in four countries: Egypt, Iraq, Morocco and Yemen.\(^2\). The vast majority in developing countries, Significant proportion of these deaths could be avoided through the effective use of Family Planning Methods (FPMs). It is estimated that, up to 100,000 maternal deaths could be avoided each year if all women who said they wanted no more children were able to stop child bearing.\(^3\).

The World Health Organization (WHO) has identified Family planning (FP) is well recognized among 4 core components of safe motherhood, the Safe Motherhood Initiative, launched in 1987, defined safe motherhood as "a woman's ability to have a safe and healthy pregnancy and delivery". Promotion of FP to increase utilization of modern contraceptive methods, specifically in countries with high birth rates, has the potential to prevent up to 32% of all maternal deaths and almost 10% of childhood deaths.\(^4\). Family planning is the voluntary pre pregnancy planning and action of individuals to prevent, delay or achieve pregnancy, Family planning information and services help individuals to maintain their overall health, also it improves the community health by helping men and women have children when they are
ready physically, emotionally and financially prepared to take on the responsibility.\(^5\). The FPMs are classified as modern and traditional, the modern methods includes: Spermicidal, barriers (cervical cap, condom), Intrauterine contraceptive device (IUCD), pills, progestin-only mini pills, injectable hormones, implants and sterilization (vasectomy, female sterilization), the traditional methods includes abstinence, calendar, coitus interrupts and lactation.\(^6\).

FP enables individuals (women and men) to plan their families and space their children. The umbrella of FP encompasses a range of services, including: FP, birth spacing counseling, provision of FP methods, infertility diagnosis, treatment and counseling, and reproductive health education. "Use of modern family planning in the developing world increased from less than 10 percent in 1965 to 53 percent in 2005. This led to a global decline in the average number of children being born to each woman from more than six to just over three children."\(^7\).

The total fertility rate of a nation is directly related to its prevalence rate of contraceptive use according to the empirical relationship between contraceptive use prevalence rate and total fertility rate, on average for every 15-percent-point increase in contraceptive use prevalence, there is a reduction of one birth per woman. Thus, countries with high total fertility rates tend to have low contraceptive use prevalence rates and vice versa, in Yemen total fertility rate 6.2 births per woman while contraceptive use prevalence rate is 27.4\(^\%\))\(^8\), whereas Sudan had contraceptive utilization rate 9% which is low among the lowest in the world (WHO 2007), and total fertility rate had fallen from 5.4 children per women to 4.6 in the period 1995 -2000 and is estimated at the same rate in 2006 .\(^9\).
FP policies and programmes in the EMR. Some countries, such as Egypt, Jordan, Kuwait, Islamic Republic of Iran, Libya, Palestine and Tunisia, are champions both in implementing successful FP programmes and in achieving favorable indicators for contraceptive prevalence. Although progress has been made towards improving FP services in many countries of the EMR, the prevalence of use of modern contraceptives remains low 17.4%, 21.7% and 5.7% respectively in Afghanistan, Pakistan and Sudan contribute up to 80%.

On the other hand, other countries in the region fear the possible impact that low fertility rates may have on the sustainability and socioeconomic structure of their communities. For example, member countries of the Gulf Cooperation Council have policies and programs that promote increased fertility along with birth spacing.

Regardless of national policies, Egyptian Demographic Family Health Survey (EDFHS) showed that 60.3% of married women in Egypt wanted no more children but only 48% were using contraceptives, and the ratio varied with place of residence. Similarly, the World Fertility Survey of Tunisia indicated that 49% of Tunisian women desired no more children; however, the actual fertility rate remains higher than expected. The family survey in Yemen2003 has shown that over all contraceptive prevalence rate (both modern and traditional methods) was 27.4% which is little higher than that it was during YDMCHS of 1997 it was only 10%. This is couple with a high actual fertility rate of 6.2, which is considered as one of the highest in the world as desired fertility is only 4.5 live births per women. It was also shown that (13.1%) of women using modern contraceptive, the current use of contraceptive among urban women (27%) is more than that of rural women (9.2%), the rate is almost three time as high among literate women (32.6%) compared to illiterate women (10.5%).
FP is not only recognized as a key intervention for improving the health of women and child but also as a human right. Child spacing is matter of choice and that couples need to make spacing decisions based on their personal preferences and situation, and on accurate information and with a range of contraceptive options available. In Yemen 37% of women experienced pregnancy with interval of less than 24 months and 16% of them had first baby before the age of 20 years 45.7% of women aged 15-19 years had less than 18 months birth interval versus 15.6% among women aged 45-49 years,8.

Yemen is developing country with a high growth rate, when it has a contraceptive prevalence rate still low, Yemen have developed population polices and program to reduce population growth rate.

In Yemen both knowledge and use of FPMs have increased considerably in recent years. However, according to results of YFHS (2003) the government sector contributes to the availability of about 52.1% of the methods used. The private sector contributes to providing about 42.8 percent of these methods, including NGOs private hospitals, doctors and pharmacies, half of currently married women know of sources of contraceptive and still only one fifth of women are currently using methods of FP.

The main cause of using family planning methods was birth spacing followed by desire to stop child birth with 78% ,21% respectively, overall birth spacing was the main cause of using family planning among women followed by desire to stop child bearing(78% versus 21% respectively), lack of knowledge (23%), husband's disapproval(16%) and religious prohibitions (15%), those are factors lead to increase growth rate in Yemen, 8.
Family Planning Methods knowledge, attitude and practice among Males and Females in Reproductive age in AL-Mukalla District  
(Nawal S Banafa, Samar S Banafa, Rasha S Bazehifan, Zahra A Ba-Azeem, Riman S Barhian, Adba M Al Tarbi) MBBS

Justification (Rational)

It is essential to identify current contraceptive knowledge and attitude before deciding on and implementing any intervention, as knowledge is a necessary initial step in the adoption of new ideas and practice related to FP.

Objective

To identify family planning methods knowledge, attitude and practice among males and females in reproductive age in AL-Mukalla District.

Materials and methods: A community-based descriptive cross-sectional study done from January to May 2012, conducted in AL-Mukalla district Hadhramout governorate, all residing women who were between 15 – 45 years old age and male who over 15 year old age included, total number of reference populations study are 600 male and female within the reproductive age, while females those who were not in reproductive age were as exclusion criteria, the sample was selected by simple random sampling method was used for conducting a house-hold searching for the target group under study. The sample size was calculated used the formula:  

\[ N = \frac{Z^2 \times P(1-P)}{D^2} \]

where \( P \) = expected prevalence of FPMs usage, \( Z \) = corresponding value of the normal standard deviation at a known level of significance with a confidence level 95%, \( Z = 1.96 \), \( D \) = the degree of accuracy desired usually set at 0.05 or at 0.02.

Using Self-administered Questionnaire, information was sought (demographic, socio-economic data, knowledge attitudes and practices related to family planning), the interviews were conducted by six female health workers in who were trained in interview technique. Data entry and analysis was done using Excel program package. A verbal consent was sort from all participants.
Results

Socio-demographic Characteristics of Respondents:

Table 1 shows the socio-demographic characteristics of respondents. About 25% were aged between (20-24 years), 30.5% female and 14% male, while the age group of (45-≥50 years) represented the lowest frequency distribution (8.8%). Majority of them were married, represented by 24.16%, 39.83% of male and female respectively from the total, 3.5% have no formal education (illiterate) while a high literacy rate 38.1%.

Awareness of Contraception Methods:

Table 2 shows knowledge of contraceptive methods for men and women, with (99.3%) for traditional contraceptive methods more than modern (were permeable to give more than one selection). Awareness of contraceptive pills (16.9%) followed by IUCD (15.8%) were the commonest modern methods known, while the safe period (rhythm) and breast feeding were the commonest traditional methods represented by (12.5%, 12.6%) respectively, the least knowledge method was implants 1.8%.

Sources of Contraceptive Information

Table 3 shows that the most common source of contraceptives aborted was Midwives and Nurses (23.9%, 18.5%) respectively most common among age group (20-24) years old, followed by doctors (18.2%) most common among age group (25-29) years old.

Benefit of Family Planning

Graph 1 shows that the believes of the persons toward the benefits of family planning, the males believe in these methods more than females, (75.7%, 55.2% respectively) includes; spacing between pregnancy (32.2% - 14% respectively) prevention of pregnancy (12.6% - 10.3%) while the remainders believe delay of pregnancy.
Complications of family planning methods

Graph 2; shows that (37.5% males and 47% females) were believes FPMs methods cause psychological upset ,sterility (33.6% males and 25.4% females)followed by change in the body function (22.4% males and 25.2% females) while the remaining problems are (cancer, irregularity of the cycle).

Practice of contraception

Table 4 shows that the Previous used of family planning methods was (23%) among age group (25-29) ,and the majority graduated from higher education(34.7%), and the least one are in age group (15-19 year) (2.1%).

Graph 3 shows the counseling were done in (65.4%) for those recent used contraceptives methods from the health provider.

Table 5 shows 29.83% recent use FPMs the most common FPMs at age 20-24 years old (24.6%),the modern methods (66.48% n=119)more than traditional ( 39.10%n=60) the common traditional methods safe period (50%) mostly at age group (40-44)years old , the common modern family planning was IUCD low (n=55 46.21%), the respondents graduated from secondary educational level (45.8%) were the most common use of both FPMs.

Table 6 reveals the reasons of not using any method of(FP) in the future are due to the side effects of the methods (34.6%),followed by religious unapproved on the (11%).
Discussion

Finding from this study show the level of ever heard about the F.P was high ,although low knowledge of at least one family planning method but this has not transformed into a high practice this is different from the studies done in Pakistan which showed 68% knew about (FP)and in Nigeria the FPMs Knowledge,(88.1%),14.

Although knowledge of at least one method of FP, there is low knowledge of individual methods this ranges from pills16.9% & ICUD 15.8% to implant ,which differ from the study done in Pakistan that found most knew about pills 68% & IUCD 55%.13 and similar to study done in Nigeria ranged from implant2.8% to condom22.9%, although this may reflect the framing of the question "Name any family planning method you Know14.

Majority got their family planning information from the health center workers (midwives and Nurses) this may be one of the good results of publicity ,education and regular work in family planning by health workers reflects the development of knowledge, only few respondents got information from others (pharmacies) ,it can therefore ,be assumed that the pharmacies has not been of much assistance in family planning dissemination ,while in Nigeria 60% received their family planning information in the hospital from midwives, and nurses .14.

the pattern of previous used of traditional contraceptives in age group 25-29 years old were 25.9%, decline in age 15-19 years old ,this approximately similar to YFHS(2003) found that 23.1% used both(13.4% &9.7% modern and traditional respectively) ,7.This pattern possibly reflect when most could have probably achieved their family size, this similar to study done in Nigeria has been found the used to be high among women in their thirty's ,15.
Although contraceptives recent use was low (29.83%), IUCD was the most frequently used, followed by pills and safe period, contrast with the findings of Nigeria were only 20% of respondents used contraceptives methods, also differ from YFHS(2003) found that 23% used family planning methods.

More than one third of respondents refuse to use FPM that reported the cause of refusal were: side effects followed with religious prohibition, this 'lower than in maternal and child survey (MCS) 1997, Yemen which showed that 64% , and lower than in FHCs2003 was 58.2% refuse to use family planning in future, while result of FHCS2003 revealed that major reasons cited by women for not using contraceptives were desire to have more children 49%, lack of knowledge 4.7%, husband disapproval 5.8% and religious prohibition 9.5%.

Regarding complication of using modern FPMs was psychological followed by fear of sterilization, while in FHS 2003 23.3% of users stop using as a result of having health problems, 18.8% wants to have more children, 18.5% reported methods failure, and 28.9% for other reasons.

Conclusion

Yemen has many activities within the reproductive health program over many decades aimed at improving maternal and child health care services (MCHs), so the intensive targeted information, education and communication (IEC) and consultation, also efforts concentrating at increase the awareness about family planning methods on women during antenatal and post-natal care, also the efforts should therefore be made by all agencies (government and non-government) involved in family planning activities in Yemen must be done according to systematic policies and programs towards eliminating the obstacles of using family planning to serve the couple's attitudes, facilitating their availability. And further qualitative and quantitative studies required regarding family planning.
References


2) 2.Roudi-Fahimi F, women reproductive health in the Middle east and North Africa. population Reference Bureau Washington,DC;2003.


9) 9.AbdekhairSM,MohamadWADescription of available contraceptive methods.Geneva Foundation For Medical Education (GFMER),Suadan,2012;Forum No(3).


Table (1): Percent Distribution of Respondents by age, marital status and health education

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Table (2) Percentage distribution of respondents, who reported knowledge of contraceptive methods by sex.

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*the participant were allowed to report more than one method.
Table (3) Percent distribution of respondents about source of Knowledge of contraception by age and education level – Mukalla district

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*The participant were allowed to report more than one method.
Table (4) Percent distribution of respondents previously used methods in relation to age and education level. N=291

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Education Levels

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<td>15</td>
<td>8.9</td>
<td>4</td>
<td>5.7</td>
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<td>3.7</td>
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<tr>
<td>Reparatory</td>
<td>26</td>
<td>15.6</td>
<td>11</td>
<td>61.7</td>
<td>16</td>
<td>29.6</td>
</tr>
<tr>
<td>Secondary</td>
<td>55</td>
<td>32.9</td>
<td>20</td>
<td>28.6</td>
<td>16</td>
<td>29.6</td>
</tr>
<tr>
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<td>33.6</td>
<td>28</td>
<td>40</td>
<td>17</td>
<td>31.5</td>
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<td>70</td>
<td>100</td>
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</table>
### Table 5: Percent distribution of recent use methods in relation to age and education level N=179

<table>
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<tr>
<th>AGE</th>
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<th>Traditional methods</th>
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</tr>
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<tr>
<td></td>
<td>pills</td>
<td>IUCD</td>
<td>Injections</td>
</tr>
<tr>
<td>15-19</td>
<td>2</td>
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<td>16.4</td>
</tr>
<tr>
<td>35-39</td>
<td>1</td>
<td>2.9</td>
<td>12.7</td>
</tr>
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<td>40-44</td>
<td>2</td>
<td>1.8</td>
<td>6.9</td>
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<tr>
<td>45-49</td>
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<td>6.9</td>
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<tr>
<td>50</td>
<td>1</td>
<td>-</td>
<td>-</td>
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<th>Total</th>
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<td>Illiterate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Read and write</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reparatory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary</td>
<td></td>
<td></td>
<td></td>
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<th>pills</th>
<th>IUCD</th>
<th>Injections</th>
<th>Condom</th>
<th>Withdrawal</th>
<th>Safe period</th>
<th>Breast feeding</th>
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<tr>
<td>Illiterate</td>
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<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
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<td>2</td>
<td>5.9</td>
<td>8.8</td>
<td>5.9</td>
<td>1.8</td>
<td>1.8</td>
</tr>
<tr>
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<td>6</td>
<td>2</td>
<td>100</td>
<td>100</td>
<td>100</td>
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<td>100</td>
</tr>
<tr>
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<td>2</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Secondary</td>
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<td>2</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>High graduated</td>
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<td>2</td>
<td>100</td>
<td>100</td>
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<td>100</td>
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<thead>
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<th></th>
<th>pills</th>
<th>IUCD</th>
<th>Injections</th>
<th>Condom</th>
<th>Withdrawal</th>
<th>Safe period</th>
<th>Breast feeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>179</td>
<td>34</td>
<td>100</td>
<td>100</td>
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<td>100</td>
<td>100</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>pills</th>
<th>IUCD</th>
<th>Injections</th>
<th>Condom</th>
<th>Withdrawal</th>
<th>Safe period</th>
<th>Breast feeding</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.6</td>
<td>1.7</td>
<td>10.6</td>
<td>16.8</td>
<td>21.2</td>
<td>24.6</td>
<td>24.6</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Descriptive text about the distribution of recent use methods in relation to age and education level)
Table (6) Percent distribution of respondents in relation to reasons of refusal using FPMs.

<table>
<thead>
<tr>
<th>Reasons</th>
<th>Married</th>
<th>Non married</th>
<th>Previously married</th>
<th>Total</th>
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<tr>
<td></td>
<td>NO</td>
<td>%</td>
<td>NO</td>
<td>%</td>
</tr>
<tr>
<td>Religious unapproved</td>
<td>15</td>
<td>9.7</td>
<td>6</td>
<td>13.7</td>
</tr>
<tr>
<td>Relatives unapproved</td>
<td>6</td>
<td>3.9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Difficult to obtain</td>
<td>3</td>
<td>2.1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Disagree family planning</td>
<td>6</td>
<td>4.6</td>
<td>2</td>
<td>4.4</td>
</tr>
<tr>
<td>Side effects</td>
<td>57</td>
<td>37.2</td>
<td>15</td>
<td>32.6</td>
</tr>
<tr>
<td>High cost</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>Husband unapproved</td>
<td>9</td>
<td>5.9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Don’t know</td>
<td>11</td>
<td>7.2</td>
<td>8</td>
<td>17.4</td>
</tr>
<tr>
<td>Menopause</td>
<td>9</td>
<td>5.9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Unsure</td>
<td>21</td>
<td>13.6</td>
<td>13</td>
<td>28.6</td>
</tr>
</tbody>
</table>
Graph (1) Distribution of respondents in relation to benefits of family planning

Graph (2) Distribution of respondents in relation to complication
Graph (3) Distribution of consultation or not about family planning
Abstract

Background: Each year, over half a million women die of complications of pregnancy, child bearing or unsafe abortion, the vast majority in developing countries, Significant proportion of these deaths could be avoided through the effective use of family planning. Family planning is recognized as among the 4 core components of safe motherhood.

Objective: Identify the knowledge, attitude and practice among males and females in reproductive age towards family planning methods in AL-Mukalla district.

Material: A total of 600 male and female, in reproductive age living in AL-Mukalla district were interviewed about their knowledge, attitude and practice of family planning. Descriptive cross-sectional study was conducted in AL-Mukalla district, 2012, using self-administered questionnaires.

Results: About 3.5% of respondents were illiterate, there knowledge (89.5%) for traditional methods (99.3%) was more than modern methods and approval (67%) about family planning methods. The females mostly preferred IUCD (16.7%) and males preferred women use pills 17.5%. The most common source of family planning information was Midwives and nurses, closely followed by doctors, the believes toward the benefits of family planning, males were more than females (32.2%-14% respectively) includes child spacing between pregnancies, prevention of pregnancy, delay of pregnancy and (37.5% males and 47% females) were believes FPMs cause psychological upset, sterility (33.6% males and 25.4% females), followed by change in the body function and other problems (cancer, irregularity of the cycle).
the Previous usage of family planning methods was 33%, at the time of this study the usage of family planning methods was (29.83%) the most common is modern (66.8%) the common was IUCD (40.2%) the most common reason for non-practice of family planning was the side effect followed by religious unapproval.

Conclusion: the intensive targeted information, education and communication (IEC) program, and efforts should move at increasing the awareness of family planning on women toward modern methods.

Key words: Family planning (FPMs), intrauterine contraceptive device (IUCD).
الخلاصة:

قدمت: أكثر من نصف مليون امرأة تتوفر في الدول النامية نتيجة مضاعفات الحمل، الولادات المتكررة والإجهاض الغير آمن. نسبة كبيرة من هذه الوفيات يمكن تجنبها من خلال الاستخدام السليم لوسائل تنظيم الأسرة.

هدف: دراسة معرفة: مقابلة وممارسة طرق تجانض تنظيم الأسرة في مدينة المكلا.

منهجية الدراسة: أجريت (2012) رجل امرأة في سن الاجئ من مكان مدينة المكلا بعد

إعداد وتوزيع الاستبانة الذاتية لإجراء الدراسة الوضعية القطنية.

النتائج: أوضحت هذه الدراسة أن 30% من المشاركين في الدراسة لديهم تعليم من المستوى الأول (أدنى الجامعي والمتوسط)، وبلغت نسبة المعرفة حول طرق ووسائل تنظيم الأسرة 89%.

للطرق التقليدية أكثر من 60% من النساء يفضلن اللولب الرحمي، 16.7% أما الرجال يفضلون الحبوب الفموية. 17.5% وجدل على معلومات وسائل تنظيم الأسرة من العاملين الصحيين والمراكز الصحية ومراكز الأمومة والطفولة، وتشير الدراسة إلى الوافق الإيجابية تجاه تنظيم الأسرة للرجال أكثر من النساء 20.2% و 14% على التوالي وتتمثل على:

الوصول إلى الأمراض يمكن تأخير الحمل، ونسبة من النساء تفضل إجراء الدراسات.

تسبب الحالات النفسية، العقم، تغيير وظائف الجسم ومضاعفات أخرى كالسرطان، واضطرابات الدورة الشهرية.

الاستخدام السابق لوسائل تنظيم الأسرة ل/full من الرجال والنساء يقدر ب(33%)

والاستخدام أثناء اجراء الدراسة لوسائل تنظيم الأسرة 99.83% و تعتبر الأطراف الحديثة في الأقل استخداما 26.8% واللولب الرحمي في أكثر الأطراف المستخدمة حاليا 40.2% ومن أهم الأسباب للاستعمال وسائل تنظيم الأسرة المضاعفات والاعتقادات الدينية وغيرها من الأسباب.

الاستنتاجات: يجب أن تبدو جهود مراعئة لتعرف الناس بالطرق الحديثة خاصة، إضافة إلى المعلومات النوعية وبرامج الاتصال التي تجلب على الوعي بين الأجل والأسافد وسائل تنظيم الأسرة الحديثة.

فخفاش الكلمات: تنظيم الأسرة، اللولب الرحمي
Indication of penetrating Keratoplasty in Hospital Universiti Sains Malaysia

Abdulrahman A Bawazir

عبد الرحمن أحمد باوزير

Department of Ophthalmology,
School of Medical Sciences, Universiti Sains Malaysia,
Health Campus, 16150 Kubang Kerian, Kelantan – Malaysia.

Faculty of Medicine, Hadhramot University for Science and Technology – Yemen.

Mohtar Ibrahim

مختار إبراهيم

Wan Hazabbah WH

وان هززيم

Department of Ophthalmology,
School of Medical Sciences, Universiti Sains Malaysia,
Health Campus, 16150 Kubang Kerian, Kelantan – Malaysia.
ABSTRACT

Our objective in this study is to describe the indication of penetrating keratoplasty operations in Hospital Universiti Sains Malaysia (HUSM).

A retrospective study on patients admitted for perform PK operation in the Department of Ophthalmology at the University of Seines Malaysia Hospital; Kota Baharu- Kelantan (HUSM) from June 2005 until June 2010. A review of the patients’ medical records for demographic data, history, clinical examinations, related laboratory investigations and PK indications, diagnosis of glaucoma, aphakia, with notification of optical and refractive parameters pre and post-operative Data collected from the process of the follow-up were also considered up to April 2010. Cases with non-corneal button transplantation had excluded.

Penetrating keratoplasty was performed in twenty three eyes of nineteen patients. Twelve (63.2%) were males and 7 (36.8%) females. The mean age was of 51.7 years (±15.6) and the range of 16-72 years. Nineteen (82.6%) eyes had primary PK and 4 (17.4%) eyes have secondary penetrating keratoplasty. The indication of PK in 7 eyes (30.4%) was infected keratitis (fungal, pseudomonas and viral), other 5 eyes (21.7%) were diagnosed with traumatic corneal injury (chemical/ non chemical). In 4 (17.4%) eyes had post Aphakic/Pseudophakic bullous keratopathy and the last three eyes (13%) with keratoconus.
The pre-operative best corrected visual acuity of twenty eyes (87%) ranged from perception of light to counting fingers, while those of the remaining three eyes (13%) were found with 6/36. Post PK on the last follow up period the best corrected visual acuity was ranged between 6/60 and 6/7.5 in 5 eyes, and in 15 (65.2%) eyes between perception of light and 1/60 and three eyes with no light perception.

The major indication of PK in this study was the infected Keratitis with perforated corneal ulcer followed by traumatic corneal injuries. Eyes with post-operative PK and with uncontrolled IOP graft failure and visual impairment were frequently seen. The larger size study is recommended to conduct to be able to generalize the results.

**Key words:** Penetrating keratoplasty, indication, Hospital Universiti Sains Malaysia, Kota Baharau, Malaysia.

**INTRODUCTION**

Corneal blindness is considered globally as one of the crucial factor for vision impairment [1]. Bilateral corneal blindness found as a major cause of visual handicap, as a consequence of a high incidence of corneal infection and ulceration. However, penetrating keratoplasty (PK), as a surgical procedure since more than 100-years [2], is considered as one of the world's most widely practiced human organ and tissue transplantation method for treating blindness [3]. In addition, it provides improvement of the ophthalmologic status in both- the doctor’s and patient’s opinion where 95% of good prognosis were found with the current techniques, such as in keratoconus. On the other hand, poor prognosis could be found in such cases with sever dry eyes, chemical burns, pemphigoid, where the success rate is much lower and approaches zero percent [4].
However in ophthalmology, PK is relatively an expensive procedure due to high price of donor cornea, long hospitalization, repeat outpatient visit, and time-and cost-consuming visual rehabilitation which usually applicable in expert corneal centers with high safety and storage standards of transplants [5].

The Malaysian National Eye Survey 1996, revealed that the corneal diseases were responsible for 3.4% of blindness and 2.5% of low vision, which considered as notable causes of visual impairment [6]. Since 1970, national ophthalmology centers that performing PK were established gradually up to 46 in 2005 [7]. This procedure was also implemented recently in our university hospital, as a tertiary level health facility for the state but not yet assessed.

**Objectives**:

The objective of this study is to describe the indication of penetrating keratoplasty operations in Hospital Universiti Sains Malaysia (HUSM).

**Methods**:

A retrospective study was performed on patients admitted for PK operations in the Department of Ophthalmology at the University of Seines Malaysia Hospital; Kota Baharu- Kelantan,(HUSM) during the period from June 2005 until June 2010. A review of the patients’ medical records for demographic data, history, clinical examinations, related laboratory investigations and PK indications, diagnosis of glaucoma, aphakia, with notification of pre and post-operative optical and refractive parameters [uncorrected visual acuity (UCVA), best corrected visual acuity (BCVA), graft clarity, anterior chamber depth, inflammatory reaction, intraocular pressure, and fundus evaluation if possible]. Follow-up period
range from one month to 56 months (mean ±SD=18.4± 15.1 months). The study excluded those patients with non-corneal button transplantation.

The indications for KP were divided into 9 large categories; modified from those used by elsewhere [8-11]. These includes Keratitis with Fungal Ulcerative conditions1; Trauma2; Chemical injury and Scarring3; Keratoconus4; Aphakic and Pseudophakic bullous keratopathy5; Pseudophakic and Glaucoma valve implantation with bullous keratopathy6; Congenital Fuchs’ dystrophy7; Regraft8; and Non-Fuchs’ dystrophy9.

**Results:**

Penetrating keratopathy was performed in twenty three eyes of nineteen patients. Twelve (63.2%) were males and 7 (36.8%) females. The mean age was of 51.7 years (±15.6) and the range of 16-72 years. Nineteen (82.6%) eyes were with primary PK. Two of them were keratoconus of the same patient. Four eyes were exposed to previous re-graft, three of them from the previous 19 eyes and one patient with rejected graft from another hospital, as seen in table 1. Fifteen patients (78.9%) were from the same state (Kota Baharu- Kelantan), 10 of them referred from Kelantan state hospitals, private clinics, and five directly followed the ophthalmology clinic. The remaining four patients were referred from Johor and Terengganu states hospital.

The indication of primary PK in 7 eyes (30.4%) was infected keratitis (fungal, pseudomonas and viral), other 5 eyes (21.7%) were diagnosed with traumatic corneal injury (chemical/ non chemical). In 4 (17.4%) eyes post Aphakic/Pseudophakic bullous keratopathy was the indication, one of them with glaucoma valve implantation and the last three eyes (13%) were with keratoconus, two of them for the same patient. In addition other PK indications
were detected in congenital scleral-corneal degeneration, Fuchs’ dystrophy, Regraft and non-Fuchs’ dystrophy one for each (4.35%)

Pre-operative secondary closed angle glaucoma was diagnosed in five eyes (21.7%) and other five (21.7%) eyes developed post PK secondary glaucoma.

**Figure1.** show the BCVA readings pre and post PK. The pre-operative BCVA of twenty eyes (87%) ranged from perception of light to counting fingers while those of the remaining three (13%) eyes were found with 6/36. Post PK operations the best corrected visual acuity ranged between light perception and 1/60 in 15 (65.2%) eyes and it was no light perception three (13%) eyes.

### Table1. Patient’s characteristic on pre and post PK

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>Age (yrs) / sex</th>
<th>Eye Oper.</th>
<th>Corneal Diagnosis</th>
<th>Glaucoma Diagnosis</th>
<th>Aphakic Status</th>
<th>No. of Regraft Surgeries</th>
<th>IOP (mmHg) (preop/final)</th>
<th>Visual Acuity (preop/final)</th>
<th>Follow-up Months / days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16/M</td>
<td>RE</td>
<td>Keris. +PFCU</td>
<td>None</td>
<td>Phakic</td>
<td>0</td>
<td>5/18</td>
<td>HM, 6/24</td>
<td>11/23</td>
</tr>
<tr>
<td>2</td>
<td>65/M</td>
<td>RE</td>
<td>PBK</td>
<td>2nd ACG</td>
<td>PCIOL</td>
<td>0</td>
<td>12/18</td>
<td>HM, NLP</td>
<td>19/16</td>
</tr>
<tr>
<td>3</td>
<td>42/M</td>
<td>RE</td>
<td>Trum.+ PBK</td>
<td>Traumatic</td>
<td>PCIOL</td>
<td>0</td>
<td>21/20</td>
<td>CF, 1/60</td>
<td>34/19</td>
</tr>
<tr>
<td>4</td>
<td>48/M</td>
<td>LE</td>
<td>Psedom. Ker./PCU</td>
<td>2nd OAG</td>
<td>Phakic</td>
<td>0</td>
<td>45/24</td>
<td>LP, NLP</td>
<td>11/7</td>
</tr>
<tr>
<td>5</td>
<td>60/F</td>
<td>LE</td>
<td>Fuch’s Syndr.</td>
<td>None</td>
<td>PCIOL</td>
<td>0</td>
<td>10/25</td>
<td>CF, CF</td>
<td>39/18</td>
</tr>
<tr>
<td>6</td>
<td>36/F</td>
<td>BE</td>
<td>Keratoc.</td>
<td>None</td>
<td>Phakic BE</td>
<td>0</td>
<td>14/15, 12/26#</td>
<td>CF, 5/60, CF, 1/60#</td>
<td>22/4</td>
</tr>
<tr>
<td>7</td>
<td>61/M</td>
<td>RE</td>
<td>PBK</td>
<td>2nd ACG, TE+Valave Implantatio</td>
<td>PCIOL</td>
<td>0</td>
<td>14/33</td>
<td>CF, HM</td>
<td>21/28</td>
</tr>
</tbody>
</table>
### Indication of penetrating Keratoplasty in Hospital Universiti Sains Malaysia

Abdulrahman A Bawazir, Mohtar Ibrahim, Wan Hazabbah WH

<table>
<thead>
<tr>
<th>No</th>
<th>Sex</th>
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<th>Diagnosis</th>
<th>Degree of Visual Acuity</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>45/M</td>
<td>LE</td>
<td>Keratoc.+Tumr Sc.</td>
<td>None, Aphakic 0</td>
<td>15/18 CF, 6/24</td>
</tr>
<tr>
<td>9</td>
<td>51/F</td>
<td>RE</td>
<td>Chem. Trum.Scars</td>
<td>None, Phakic 0</td>
<td>15/18 CF, 1/60</td>
</tr>
<tr>
<td>10</td>
<td>55/M</td>
<td>LE</td>
<td>Trum.Keris. +PFCU</td>
<td>None, Phakic 0</td>
<td>22/19 PL, HM</td>
</tr>
<tr>
<td>11</td>
<td>45/M</td>
<td>RE</td>
<td>Chem. Trum. +BK 2nd ACG + TE</td>
<td>Phakic 1</td>
<td>28/24 HM, 20/29* PL/CF*</td>
</tr>
<tr>
<td>12</td>
<td>58/F</td>
<td>LE</td>
<td>Keris. +PVCU</td>
<td>None, Phakic 0</td>
<td>18/22 HM, CF</td>
</tr>
<tr>
<td>13</td>
<td>70/F</td>
<td>LE</td>
<td>Trum. + PCU</td>
<td>None, Phakic 1</td>
<td>14/10 HM, 10/27* 6/36, 1/60 CF, HM*</td>
</tr>
<tr>
<td>14</td>
<td>53/F</td>
<td>RE</td>
<td>Keris. +PCU</td>
<td>None, Phakic 0</td>
<td>14/10 HM, 6/7,5</td>
</tr>
<tr>
<td>15</td>
<td>20/M</td>
<td>LE</td>
<td>Cong.Sclero-corneal deg.</td>
<td>None, Phakic 0</td>
<td>13/10 HM, HM</td>
</tr>
<tr>
<td>16</td>
<td>29/F</td>
<td>LE</td>
<td>Failed graft/Chem. Trum. 2nd ACG</td>
<td>Phakic 1</td>
<td>27/33 6/36, NLP</td>
</tr>
<tr>
<td>17</td>
<td>67/M</td>
<td>LE</td>
<td>Non Fuch’s Keratop.</td>
<td>None, Phakic 0</td>
<td>10/15 HM, 6/45</td>
</tr>
<tr>
<td>18</td>
<td>68/M</td>
<td>RE</td>
<td>Keris. +PFCU</td>
<td>None, Phakic 1</td>
<td>12/16 16/19* PL, PL, PL*</td>
</tr>
<tr>
<td>19</td>
<td>72/M</td>
<td>LE</td>
<td>Keris. +PCU</td>
<td>None, Phakic 0</td>
<td>22/32 HM, CF</td>
</tr>
</tbody>
</table>


PL: Perception of light. CF: Counting Fingers. NLP: No light perception

![Graph](image)

Figure 1 stated best visual acuity pre and post PK

**Discussion:**

Penetrating keratoplasty is an effective treatment for selective corneal disorders (12). This type of intervention, however, had highly successful improvement of vision and quality of life for those patients who underwent PK after being with corneal blindness (5, 13). Among the 23 eyes who had been operated 19 (82.6%) of them were considered as primary PK. However, three (15.8%) of them were re-grafted due to rejection of the first graft; sever button infection or secondary glaucoma. One eye had been re-grafted for the first time due to failure of previous PK done elsewhere.

Several papers reported that Pseudophakic bullous keratopathy was the first indication of PK (8, 14, 15). In our case, we found that
infected Keratitis with perforated corneal ulcer (30.4%) was the major indication of PK, followed by traumatic corneal injuries and post Aphakic/Pseudophakic bullous keratopathy comes as the 3rd cause of PK. These findings were inconsistent with what was found by Dorrepaal or Dandona (16, 17).

In those cases with post PK secondary glaucoma the uncontrolled IOP leads consequently to graft failure and visual impairment. Five eyes (21.7%) were developed post PK secondary glaucoma which is in accordance with other studies of secondary glaucoma followed PK with an incidence of 9-35% (18). Sinha et al, showed that post-PK glaucoma were ranged between 26.6% in cases and up to 50% in controls (2), which is higher than what we found in our study. On the other hand Karimian et al, state that secondary glaucoma was not a significant cause of graft failure in PK (19).

Fifteen (65%) eyes post PK their BCVA was between perceptions of light and 1/60, five eyes range between 5/60, and 6/7.5, and three eyes with no light perception. Thirteen eyes BCVA <3/60 which not concise with other study done elsewhere (2, 20).

**CONCLUSION:**

The study concluded that penetrating keratoplasty is an effective treatment for selective corneal disorders with highly successful improvement of vision and quality of life for those patients with corneal blindness. Grafting of the eye has to be performed carefully from being contaminated and infected. The major indication of PK in this study was the infected Keratitis with perforated corneal ulcer followed by traumatic corneal injuries. However in cases with post PK secondary glaucoma and with uncontrolled IOP, graft failure and visual impairment were frequently seen.
Despite the good results obtained from this stay, findings should be interpreted fairly because of the limited number of the sample size which also considered as the main limitation of this study. Therefore, larger size study is recommended to be conducted in order to be able to generalize the results.

**ACKNOWLEDGEMENT:**

The authors wish to express their grateful thanks to workers of the department of the registration University of Seines Malaysia Hospital; Kota Baharu- Kelantan,(HUSM) for their helpfulness. And to Amin A Bawazir –PhD-, Faculty of Medicine-Aden University, for his thoughtful comments on this essay.
References


دواعي إجراء عمليات زراعة القرنية بين مرضى عمليات العيون في مستشفى العلوم الجامعي بماليزيا - كوتابارو - ولاية كلينتان - ماليزيا

أجريت هذه الدراسة الوصفية التراجعية بين المرضى الذين أجريت لهم عمليات جراحية في قسم العيون بمستشفى العلوم الجامعي بماليزيا - بمدينة كوتابارو، ولاية كلينتان في الفترة من يونيو 2005 حتى فبراير 2010م. تم تصميم استمارة خاصة بجمع المعلومات ذات العلاقة بالمرضى المرشحين التي أجريت لهم عمليات زراعة القرنية الأولية أو الثانوية بالقسم والذي تضمنت معلومات ديموغرافية عن المريض، التاريخ المرضي والنتائج الفحصي الإكلينيكي والمخبري والتشخيصي المؤدي لهذه العملية، الأمراض العينية المصاحبة لتعتم القرنية، الإصابة بضغوط العين، عمليات إزالة العدسة ومعدلات البصر قبل وبعد العملية، المعلومات المثبتة أثناء العملية، والتابعة الدورية للمريض حتى إبريل 2010م. مع استثناء الحالات التي لم يتم لها زراعة قرنية آنشة.

أوضحت النتائج المستخلصة للدراسة أنه بلغت عدد الأعين التي أجريت لها عملية زراعة القرنية ثالثًا وعشرين عينًا لتسعة عشر مريضًا. منهم اثنا عشر ذكرًا (63.2%)، وسبع من الإناث (36.8%)، المتوسط العمرلي لهم (51.7) عامًا، ما بين 16-72 عامًا. لقد أجريت عملية زراعة القرنية لتسعة عشر (68.2%) عينًا لأول مرة، وأعيد زراعة القرنية للمرة الثانية لأربعة (17.4%) أعين. إن دواعي إجراء عملية زراعة القرنية الأولية حسب التسلسل العددي - تمثلت بسبع عيون مصابية بالالتهابات تترحمية للقرنية، وخمس عيون إصابات كيميائية وغير كيميائية، وأربع عيون نتيجة لتعتم القرنية الثانوي بعد عمليات السادات البيضاء، أما العيون الثلاث الأخيرة فكانت نتاج للقرنية المخروطية.

من خلال دراسة أفضل معدلات البصر قبل عملية زراعة القرنية بين أن عشرين (87%) عيبًا يترابح بصرها بعد تحديد مصدر الإضاءة إلى عد الأصابع، بينما ثلاثة (13%) عيون حدة البصر لديها 2/6. أما بعد عملية زراعة القرنية، فآخر زيادة متابعة للحالات اتضح أن خمسة عيون أفضل معدلات البصر لديها يتم أو من 6/10 إلى 6/7.5، وخمسة
Indication of penetrating Keratoplasty in Hospital Universiti Sains Malaysia
Abdulrahman A Bawazir, Mohtar Ibrahim, Wan Hazabbah WH

عشر عينًا أفضل معدلات البصر لديها يتراوح بين تحديد مصدر الإضاءة إلى 1/60، بينما ثلاثة عيون الأخيرة فاققة البصر وغير قادرة على تحديد مصدر الإضاءة.

استخلصت الدراسة أن أرفع النسب لدواعي إجراء عمليات زراعة القرنية وحصص هذا المستشفى هي الالتهابات التترحية للقرنية، تليها إصابات القرنية النافذة، وبينت الدراسة أن هناك بعض العيون التي خضعت لعملية زراعة القرنية أصيبت بمضاعفات عدم السيطرة على الضغط العيني المصاحب بفشل العملية بتعتم القرنية الثاني، لذلك توصي الدراسة بتوسيع الجانب العددي لحالات عمليات زراعة القرنية حتى يتم تعميم النتائج المتترنة على ذلك.

الكلمات المفتاحية: زراعة القرنية ، الدواعي الطبية ، مستشفى العلوم الجامعي بماليزيا ، كوتابارو ، ماليزيا.
Inequalities for some functions are related to the confluent hyper geometric function

Raed S. Batahan
Department of Mathematics, Faculty of Science, Hadhramout University, 50511 Mukalla, Yemen.

Ayman Shehata
Department of Mathematics, Faculty of Science, Assiut University, Assiut 71516, Egypt.
Department of Mathematics, College of Science and Arts in Unaizah, Qassim University, Qassim 10363, Kingdom of Saudi Arabia.
Abstract

This paper is motivated by an open problem of inequalities of confluent hypergeometric functions. Our goal is to derive some inequalities for error, incomplete gamma and Whittaker's functions.

AMS Mathematics Subject Classification(2010): 26D15; 30A10; 26D07.

Keywords: Confluent hypergeometric function; Incomplete gamma function; Error function; Whittaker's function.

1. Introduction

Inequalities for the ratio of confluent hypergeometric functions are described in the literature. The two sided inequalities for confluent hypergeometric functions have been established by Luke [7, 8, 9, 10]. The second author has earlier studied the inequalities for Humbert functions [14]. The reason for interest in this family of incomplete gamma, error and Whittaker's functions are related to their intrinsic mathematical importance and the fact that these functions have applications in physics. Here we obtain some inequalities for incomplete gamma, error and Whittaker's functions. The following relations bring about various applications in the theory of inequalities of special functions [2, 3, 4, 5, 12]. As natural relations to the foregoing discussion, it is pertinent to examine the inequalities of the ratios of confluent hypergeometric function [1, 6],

Theorem 1.1. (i) Let \( a > 0, c > 0, 0 < x < 1, \) then

\[
1 + \frac{a}{c} x < \Gamma_1(a;c;x) < 1 + \frac{2a}{c} x. \tag{1.1}
\]

(ii) Let \( c > a > 0, x \neq 0, \) then

\[
e^{-c} x < \Gamma_1(a;c;x) < 1 + \frac{a}{c} (e^x - 1). \tag{1.2}
\]
Theorem 1.2. Let $c > a > 0$ and $y > x > 0$, then

$$e^{y-x} < \frac{1_F(a; c; x)}{1_F(a; c; Y)} < 1.$$ (1.3)

Theorem 1.3. (i) Let $a > 0$, $b > 0$, $c > 0$, $d > 0$, $0 < x < 1$ and $0 < y < 1$, then

$$\frac{1 + \frac{a}{c}x}{1 + \frac{2b}{d}y} < \frac{1_F(a; c; x)}{1_F(b; d; y)} < \frac{1 + \frac{2a}{c}x}{1 + \frac{b}{d}y}. \quad (1.4)$$

(ii) Let $c > a > 0$, $d > b > 0$, $x > 0$ and $0 < y < 1$, then

$$\frac{1 - \frac{a}{c}x}{1 - \frac{b}{d}y + \frac{b(b + 1)}{2d(d + 1)}y^2} < \frac{1_F(a; c; -x)}{1_F(b; d; -y)} < \frac{1 - \frac{a}{c}x + \frac{a(a + 1)}{2c(c + 1)}x^2}{1 - \frac{b}{d}y}. \quad (1.5)$$

In the next three sections, we will discuss some inequalities for the error, incomplete gamma and Whittaker’s functions.

2. Inequalities for error function of complex variable

We note the following link between the error function $erf(x)$ of complex variable and the confluent hypergeometric function $1_F$ [11, 13] in the form

$$erf(x) = \frac{2x}{\sqrt{\pi}} 1_F\left(\frac{1}{2}; \frac{3}{2}; -x^2\right). \quad (2.1)$$

From the results (1.1)-(1.5), we have the following inequalities

$$\left(1 - \frac{1}{3}x^2\right)\left(\frac{2x}{\sqrt{\pi}}\right) < erf(x) < \left(1 - \frac{2}{3}x^2\right)\left(\frac{2x}{\sqrt{\pi}}\right); \quad -1 < x^2 < 0, \quad (2.2)$$

$$e^{-\frac{1}{3}x^2}\left(\frac{2x}{\sqrt{\pi}}\right) < erf(x) < \left(\frac{2x}{\sqrt{\pi}}\right)\left(1 + \frac{1}{3}\left(e^{-x^2}\right) - 1\right); \quad -x^2 \neq 0 \quad (2.3)$$

$$e^{y^2-x^2}\left(\frac{x}{y}\right) < \frac{erf(x)}{erf(x)} < \frac{x}{y}, \quad y^2 < x^2 < 0, \quad (2.4)$$

$$\left(1 - \frac{1}{3}x^2\right)\left(\frac{x}{y}\right) < \frac{erf(x)}{erf(x)} < \left(1 - \frac{2}{3}x^2\right)\left(\frac{x}{y}\right); \quad -1 < x^2 < 0, -1 < y^2 < 0 \quad (2.5)$$
The incomplete error function is defined by

\[ \text{erfc}(x) = 1 - \text{erf}(x). \] (2.7)

Some special cases of inequalities for \( \text{erf}(x) \) are listed below:

\[ 0.611205382176735977527086072524i < \text{erf}(\frac{1}{2}i) < 0.658221180805715668106092693488i, \]
\[ 0.08051900342310835617888177364 < \text{erf}(1) < 0.89062194387053995037752865228, \]
\[ 0.41451449909020017150732275467154 < \frac{\text{erf}(\frac{4}{7}i)}{\text{erf}(\frac{1}{2}i)} < 0.5, \]
\[ 1.5129310344827586203896551724138 < \frac{\text{erf}(\frac{1}{2}i)}{\text{erf}(\frac{1}{3}i)} < 1.6875, \]
\[ 1.565101070154577834720570749108 < \frac{\text{erf}(\frac{1}{4}i)}{\text{erf}(\frac{1}{3}i)} < 1.5760044642857142857142857142857. \]

### 3 Inequalities for incomplete gamma function

Let us consider a naturally terminating \( _1F_1 \) [11, 13], for a non-negative integer \( a \), then the incomplete gamma function \( \gamma(a, x) \) of complex variable \( z \) are defined by

\[ \gamma(a, x) = a^{-1}x^a {}_1F_1(a; a + 1; -x). \] (3.1)

From (1.1), (1.2) and (3.1), we have

\[ \left( 1 - \frac{a}{a + 1} x \right) \left( \frac{x^a}{a} \right) < \gamma(a, x) < \left( 1 + \frac{a}{a + 1} x \right) \left( \frac{x^a}{a} \right); a = 2, 4, \ldots, -1 < x < 0, \] (3.2)

\[ \left( 1 - \frac{a}{a + 1} x \right) \left( \frac{x^a}{a} \right) < \gamma(a, x) < \left( 1 - \frac{a}{a + 1} x \right) \left( \frac{x^a}{a} \right); a = 2, 4, \ldots, -1 < x < 0, \] (3.3)

\[ \exp \left( -\frac{a}{a + 1} x \right) \left( \frac{x^a}{a} \right) < \gamma(a, x) < \left( 1 + \frac{a}{a + 1} (e^x - 1) \right) \left( \frac{x^a}{a} \right); a = 2, 4, \ldots, x < 0, \] (3.4)

\[ \exp \left( -\frac{a}{a + 1} x \right) \left( \frac{x^a}{a} \right) < \gamma(a, x) < \left( 1 + \frac{a}{a + 1} (e^x - 1) \right) \left( \frac{x^a}{a} \right); a = 2, 4, \ldots, x > 0 \] (3.5)

From (3.1) and (1.3), we find that

\[ e^{y-x} \left( \frac{x^a}{y} \right) < \gamma(a, x) < \left( \frac{x^a}{y} \right); a > 0, \quad y < x \] (3.6)

Thus, combining (1.4), (1.5), (3.1) and (3.2), we get
Inequalities for some functions are related to the confluent hypergeometric function

\[
\left(1 - \frac{a + 1}{b + 1} \right) \left( \frac{bx^a}{ay^b} \right) < \frac{\gamma(a, x)}{\gamma(a, y)} < \left(1 - \frac{2a + 1}{b + 1} \right) \left( \frac{bx^a}{ay^b} \right); \quad a, b > 0, -1 < x < 0, -1 < y < 0 \tag{3.7}
\]

and also, for \(a, b > 0, x < 0, -1 < y < 0\), we get

\[
\left(1 + \frac{a + 1}{b + 1} x \right) \left( \frac{b(-x)^a}{b(-y)^b} \right) < \frac{\gamma(a - x)}{\gamma(b, -y)} < \left(1 + \frac{a + 1}{b + 1} x + \frac{ax^2}{b(y + 2)} \right) \left( \frac{b(-x)^a}{b(-y)^b} \right). \tag{3.8}
\]

Our interest is to show that our inequality (3.6) gives inequality at \(x = 1, y = 0.5\) and \(a = 1\)

\[
1.2631578947 < \frac{\gamma(1, 1)}{\gamma(1, 0.5)} < 1.7777777777,
\]
\[
0.452418709 < \frac{\gamma(1, -0.25)}{\gamma(1, -0.5)} < 0.5,
\]
\[
0.804299927 < \frac{\gamma(1, -0.8)}{\gamma(1, -0.9)} < 0.8888888888,
\]
\[
0.8333333333 < \frac{\gamma(1, -0.5)}{\gamma(1, -0.5)} < 1.2,
\]

and from (3.2), we have

\[
0.166666666666666666667 < \gamma(2, -0.5) < 0.20833333333333333333333.
\]

4 Inequalities for Whittaker's function

The Whittaker's function \(M_{k,m}(x)\) are linked to the confluent hypergeometric function \(_1F_1\) [11, 13] by the following relation

\[
M_{k,m}(x) = x^{m+\frac{1}{2}}e^{-\frac{1}{2}x} \ _1F_1(\frac{1}{2} + m - k; 2m + 1; x). \tag{4.1}
\]

From (1.1), (1.2) and (4.1), we have

\[
\left(1 + \frac{m + 1 - k}{2m + 1} x \right) x^{m+\frac{1}{2}}e^{-\frac{1}{2}x} < M_{k,m}(x) < \left(1 + \frac{1}{2} + m - k \right) \left(2m + 1 \right) x^{m+\frac{1}{2}}e^{-\frac{1}{2}x},
\]

\[
m > -\frac{1}{2}, m - k > -\frac{1}{2}, 0 < x < 1, \tag{4.2}
\]

\[
\left( \frac{m+\frac{1}{2}-k}{e^{2m+1}} \right) x^{m+\frac{1}{2}}e^{-\frac{1}{2}x} < M_{k,m}(x) < \left(1 + \frac{1}{2} + m - k \right) \left(2m + 1 \right) x^{m+\frac{1}{2}}e^{-\frac{1}{2}x},
\]

\[
2m + 1 > \frac{1}{2} + m - k > 0, x \neq 0. \tag{4.3}
\]
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It therefore readily follows from (1.3) that

\[
\left( \frac{x}{y} \right)^{m+\frac{1}{2}} \frac{1}{e^{x-y}} < \frac{M_{k,m}(x)}{M_{k,m}(y)} < \frac{1}{e^{x-y}},
\]

\[2m + 1 > \frac{1}{2} + m - k, \quad y > x > 0. \tag{4.4}
\]

Also, from (1.4), (1.5) and (4.1), we have

\[
\left( \frac{1 + m + \frac{1}{2} - k}{2m + 1 - x} \right)^{m+\frac{1}{2}} \frac{1}{e^{x-y}} < \frac{M_{k,m}(x)}{M_{l,n}(y)} < \frac{1 + m + 1 - 2k}{2m + 1 - x} \frac{1}{(m + \frac{1}{2} - l + \frac{1}{y})(y^{m+\frac{1}{2}} e^{-x/y})};
\]

\[m, n > -\frac{1}{2}, m - k, n - l > -\frac{1}{2}, 0 < x, y < 1, \tag{4.5}
\]

\[
\left( \frac{n + \frac{1}{2} - l}{2m + 1 - x} \right)^{m+\frac{1}{2}} \frac{1}{e^{x-y}} < \frac{M_{k,m}(-x)}{M_{l,n}(-y)} \left( \frac{-x}{-y} \right)^{m+\frac{1}{2}} e^{x/y};
\]

\[2m + 1 > \frac{1}{2} + m - k > 0, 2n + 1 > \frac{1}{2} + n - k, x > 0, 0 < y < 1. \tag{4.6}
\]

Not only do our results hold under weaker conditions but they also provide sharper bounds for \(y > x\) when compared with Bordelon’s result (4.1). Further, the results obtained have the advantage that the ratio of the Whittaker’s function \(\frac{M_{k,m}(x)}{M_{k,m}(x)}\) satisfies a two-sided inequality.

For example, for the set of values \(x = 0.5, y = 1, m = n = 0.5, k = l = -0.5\), we have from (4.5)

\[
0.38940039153570243412258513348916 < \frac{M_{-0.5,0.5}(0.5)}{M_{-0.5,0.5}(1)} < 0.64201270834387074203671028403122
\]

whereas from (4.5) we have the lower bound

\[
0.79718017958948967045699624187112 < \frac{M_{-1,1}(0.8)}{M_{-1,1}(0.9)} < 0.88102035094862594938339159598956.
\]
and for the set of values \( x = 0.8, \ y = 0.9, \ m = n = -25, \ k = l = 0 \) we have from (4.5)

\[
0.8968277020381758792641207721051 < \frac{M_{0m-0.25}(0.8)}{M_{0-0.25}(0.9)} < 0.99114789481720419305631554548825.
\]

In conclusion we observe that on repeated application of the known bounds of confluent hypergeometric functions, more results could be obtained inequalities for incomplete gamma, error and Whittaker's functions, but the details are omitted for reasons of brevity. Further results and applications will be discussed in a forthcoming paper.

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knowledge, attitude and practice of primary and secondary school students toward tobacco use in Al-Mukalla city

Abdulkader Mohamed Bayazid
Samaher Yahya Ba-Farjoom
Aymen Saleh Qamzawy
مجملة الأندلس للعلوم والتقنية، Academy of Science and Technology (AUST)

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Abdulkader Mohamed Bayazid, Samaher Yahya Ba-Farjoom, Aymen Saleh Qamzawy
knowledge, attitude and practice of primary and secondary school students toward tobacco use in Al-Mukalla city

Abstract

Background: The habit of tobacco use is initiated during early youth and this age group require constant monitoring and timely appropriate action to curtail usage.

Objective: To assess Knowledge, attitude and practice of primary and secondary school students toward tobacco use in Al-Mukalla city.

Design & Methods: A cross-sectional -based study was carried out from February to April - 2010 among 3688 primary and secondary school students selected randomly by using self-administered questionnaire.

Results & Conclusion: The study indicated that 8.3% of students are current tobacco use. 18.2% of students used tobacco only for one time and main cause was to try 49.4%. Despite Exposure to passive tobacco smoke is now accepted as a real risk to health, most of the students exposed to passive smoking 82% and Transport facility was the most common site of exposure.
المؤسسة:

الخلفية: عادة استخدام التبغ تبدأ في سنوات الشباب المبكرة وهذه الفترة العمرية تحتاج إلى تطبيق إجراءات مناسبة في الوقت المناسب للحد من هذه العادة.

هدف الدراسة: هو تقييم معالم سلوك طلاب وطالبات المرحلة الأولى والثانوية نحو استخدام التبغ في مدينة إماراتية.

تصميم ومنهج الدراسة: هذه دراسة مقطعية تم تطبيقها في الفترة من فبراير إلى أبريل 2010م على 3688 طالبًا وطالبة من المرحلة الأولية والثانوية تم اختيارهم عشوائيا، وتم جمع المعلومات عن طريق تعبئة المشاركون والمشاركات للاستبانة.

النتائج والاستنتاجات: بينت الدراسة أن 8.3% من الطلاب يستخدمون التبغ حالياً، و18.2% من الطلاب استخدموا التبغ مرة واحدة فقط وكان السبب الرئيس هو التحية. 49.4%. على الرغم من أن التعرض للدخان السبلي أصبح مقبولاً كخطر حقيقي على الصحة إلا أن معظم الطلاب يعرضون للدخان السبلي 82% و تعتبر وسائل النقل العامة المكان الأكثر شيوعا للتعرض.
Introduction:

Tobacco use, primarily cigarette smoking, is a major preventable public health risk in most of the developing countries of the world. According to world health organization (WHO), nearly 5 million persons die annually from tobacco-related illnesses, and many more suffer from smoking-related morbidity while the number of deaths expected to be double by year 2020. 70% of these deaths will occur in developing countries \(^1\). Information on tobacco use among young people is not available for most developing countries. To remedy this lack and to create a baseline from which trends in tobacco use among young people can be measured, several agencies, including the WHO and central disease control (CDC) in the USA, has launched a Global Youth Tobacco Survey (GYTS)\(^2, 3\), which represents a school-based survey focusing on adolescents students aged 13 to 15 years designed to determine the level of tobacco use, estimate the age of initiation of cigarette use, estimate the level of susceptibility to become a cigarette smoker, estimate the exposure to tobacco advertising, identify key intervening variable, such as attitude and beliefs on behavioral norms with regard to tobacco use among young people and assess the extent to which major prevention programs are reaching school-based populations and establish the subjective opinions of those populations regarding such intervention \(^4\).

In many Organization of the Islamic Conference (OIC) countries attitudes to tobacco use are ambiguous. The prevalence of tobacco use among men in these countries is generally high with rates ranging from 69% in Indonesia, 51% in Turkey and 40% in Egypt, while it is much lower in women ranging from 2% to 11 % \(^5\). Tobacco control legislation in most Muslim countries is still at a rudimentary stage, with limited restrictions on smoking in public places and advertising being the most common. \(^6\)
In Yemen, the prevalence of smoking among adults is 77% among males and 29% among females, while in Aden secondary school students the estimated prevalence is 19.6%. The GYTS revealed that students currently use any form of tobacco are 21% in Sana'a, 16% in Aden, and 18% in Hadramout.\(^{(7)}\)

The aim of this study is to assess knowledge, attitude and practice of primary and secondary school students toward tobacco use in Al-Mukalla city.

**Objectives:**

General: To assess Knowledge, attitude and practice of primary and secondary school students toward tobacco use in Al-Mukalla city

**Specific:**

1- To assess the frequency of tobacco use and determine the significant association with gender and level of school among school students.

2- To identify the reasons for use and non use tobacco products among primary and secondary school students.

3- To determine the significant association between exposure to passive smoking according to gender and level of school.

4- To assess the knowledge level and attitude of school students toward tobacco use.

5- To identify the sources of knowledge among school students toward hazards of tobacco use.
Materials and methods:

Study design: A cross-sectional school-based study was conducted from February to April - 2010 among primary and secondary school students.

Study area and population: The study was carried out in Al-Mukalla city, which is the capital city of Hadramout governorate. The study population was primary school students from seventh to ninth grade and all grades of secondary school students in both public and private schools.

Sampling: The needed sample size of study was calculated by using the Epi-info program (version 3.5.1), based on the following indicators: the total number of study population 17522, the study proportion was assuming to be 50% of primary and secondary school students use tobacco products, the absolute precision (error allowable) 2% and confidence limits to be 99% . The needed sample size was estimated to be (3353) students. Then 10% was added to overcome the refused students, so it turned out to be (3688).

A two-stage sampling design was used to give a representative sample of students in primary and secondary schools.

Selection of schools: A list of public and private schools which eligible to participate in the study was taken. A total of thirty five (35) public schools and ten (10) of private schools were selected with probability proportional to school enrollment size. (35).

Selection of students: Selection the number of students from each eligible level in the school done by stratified sampling method. Then the needed students from each level were chosen by probability systematic random sampling selection from 2-3 classes.
Data about the number of schools and distribution of students in each level by gender were obtained from department of statistics and information in Ministry of Education.

Data Collection Procedures and Methods: The study tool for data collection was a self-administered questionnaire pre-tested on convenient sample of 40 students, as a result of this pre-test some items were discarded and others were modified due to ambiguity of these questions.

The questionnaire consisted of 34 questions divided in seven parts and each part consists of many questions which were constructed based on the study objectives.

- **Part one:** student’s background such as (age, gender, type of school, name of school and school level).

- **Part two:** types of tobacco use and causes of use and non use of tobacco. The tobacco use in our study mainly have three forms: *Cigarette, Hookah or Shisha* (instrument for smoking tobacco in which the smoke is cooled and filtered by passing through water) and *Quid* (a lump of chewing tobacco). For analytical purpose three main categories of students were identified in the study which defined as follow:

  1. **Ever tobacco users:** were defined as anyone who had used tobacco even once in any form at any point in a lifetime.

  2. **Current tobacco users:** were those who had used tobacco in any form during the 30 days preceding the study and past users were defined also as ever users.

  3. **Never tobacco users:** were those who had never used tobacco.

- **Part three:** smoking of cigarette and hookah which includes four questions concerning age of initiation, usual site of smoking, who know about his/her smoking and did he/she want to stop it?
• **Part four:** use of quid which includes four questions concerning age of initiation, usual site of chewing, who know about his/her chewing and did he/she want to stop it?

• **Part five:** passive smoking which includes two questions concerning exposure to cigarette smoke and site of exposure.

• **Part six:** their sources of knowledge toward hazards of tobacco use.

• **Part seven:** level of knowledge and attitude toward tobacco use.

  Questions to assess the level of knowledge of tobacco use consist of 6 questions. Correct answer for each question was assigned one mark whereas incorrect and unknown answer given zero, so the total maximum score for knowledge was 6 marks.

So the study sample divided according to their answers into three levels as following:

- 0-2 marks = low level of knowledge.
- 3-4 marks = intermediate level of knowledge.
- 5-6 marks = high level of knowledge.

The collection of data was done by trained fourth year medical students in the absence of any school teacher or any school personnel in classrooms after taking permission to enter the schools and run the study procedures. Students were assured about confidentiality of responses and data would be used only for stated research purposes.

The researchers checked the questionnaire for completeness and then coded to facilitate its entry and analysis in computer. This was done to establish quality data management throughout the data gathering process.

**Statistical methods:** To ensure the accuracy of data processing, the data were analyzed by using (SPSS, version 16.0). Mean and standard deviation were described in age variable of primary and secondary school students. Categorical variables were described by
using frequency distribution and percentage. To analyze the association between the variables chi-square test was used with significant level 1% and also odds ratio.

Ethical consideration: The study proposal was prepared by the researchers and was evaluated by the family and community medicine department. Written permission was granted from Ministry of Education in Hadramout governorate through official letter to all schools included in the study. Then an oral permission from managers of schools as well as students was obtained before initiation of the study.

**Results:**

**Study population:** The study sample was 3688 primary and secondary students. Most of the students agreed to participate except 1.8% didn’t respond. Therefore, the total number of participants was 3621 students with response rate 98.2%. Primary school students formed 63.3% (2243) of the sample and 36.7% (1328) were secondary school students. Moreover, most studied sample 91.2% (3304) from public schools.

The mean age of students was (16) years and the range was between 11-23 year, median and mode were (15) years and the standard deviation was (±2).

**Tobacco use:** In this study we found that 18.2% (658) has used ever tobacco and 8.3% (301) was on current tobacco use, while 81.9% (2964) of the students have never use tobacco (Figure 1). Most of school students who ever and current use tobacco were used tobacco chewing more frequent than other forms of tobacco products 67.2% (442), 79.1% (238) respectively. (Figure 2, 3).

The initiation age of cigarette smoking for the first time was more frequent between 14-16 years 28.8%. 52.2% of the students, who
smoked, smoked at common place, the rest smoked at home and friend’s home by 26.5% and 17.3% respectively. Also we found that friends were mostly who know that the students who smoked by 46% (220), While the parents were the least one who knew about the smoking of their son students who smoke 8.4% (40).

The study revealed that 73.7% (112) of the current smoking students would like to cease smoking. Only 26.3% (40) did not want to cease smoking.

The initiation age of the students who tobacco chewing started at age 11-13 years 35.2% (160). Public places were the most common site of tobacco chewing 68% (310), the rest chewed at school and home by 22% (101) and 20% (92) respectively.

Friends were mostly the people who knew about the student who chewed by 58% (279), while parents were the least one who knew 10% (51).

Most of the students who current tobacco chewing would like to cease chewing 72.5% (185). Only 27.5% (70) who did not want to cease.

This study showed that ever tobacco use was more frequent among male students 16% (578) than female students 2% (80). With a P-value < 0.01 there is statistically significant association between male students and ever tobacco use. Tobacco ever use among males are six times more than in females (OR = 6.33), Confidence interval (CI) = 4.93- 8.15. Also ever tobacco use were more frequent among secondary school students 10% (355) than primary school students, 8% (303) with a P-value<0.01 there is statistically significant association between primary school students and ever tobacco use. Tobacco ever use among primary school students are less likely than secondary school students (OR = 0.42), CI = 0.35- 0.50. (Table 1).
Current tobacco use was more frequent among male students 8.2% (296) than female students 0.1% (5). With a P-value < 0.01 there is statistically significant association between male students and current tobacco use. Current tobacco use among males is forty six time more than in females (OR = 46.41), CI = 18.49- 127.43. And also current tobacco use was more frequent among secondary school students 4.7% (169) than primary school students 3.6% (132). With a P-value < 0.01 there is statistically significant association between secondary school students and current tobacco use. Current tobacco use among primary school students are less likely than secondary school students (OR = 0.42), CI = 0.33- 0.54. (Table 2)

According to this study, the most common cause for initiation ever tobacco use among school students was want to try it 49.4% (325) followed by influence by friends 37.8% (249) by ever users, while 23.1%(152) said that they used it just for fun. (Table3).

Current users 31.6% (97) reported that addiction was the most common reason for the continuation of tobacco use followed by the influence by friends 30.9% (93). (Table 4).

The reasons by never users for not using tobacco included forbidden by Islam 66.3% (1967), awareness about the harmful effects of tobacco use to health 57.1% (1695), lack of interest or dislike for tobacco use 40.3% (1195) and social reasons 27.8% (823). (Table 5). Social reasons included the negative association of tobacco use with an individual’s character and social image.

**Passive smoking:** The study showed that 82% (2967) of students were exposed to passive smoking. This exposure was more frequent among male students 47.3% (1713) than female students 34.6% (1254).With a P-value < 0.01 there is statistically significant association between male students and exposure to passive smoking. Exposure to passive smoking was more frequent among
primary school students 50% (1803) than secondary school students 32% (1164). With a P-value < 0.01 there is statistically significant association between primary school students and exposure to passive smoking. (Table 6).

The most common site of exposure to passive smoking among both male and female students was common public transport facility 64% (1370), 67% (985) respectively. The second site of exposure to passive smoking was at home male students by 23% (501) and female students by 34% (496). (Table 7).

Knowledge level and attitude: The study revealed that 65.5% (2371) of participants had high level of knowledge, only 6.3% (229) had gained low level of knowledge and the rest of participants were categorized in the intermediate level of knowledge 28.2% (1021). (Figure. 4).

The study showed that 8% (288) of school students think that tobacco use give them confidence about themselves, most of school students want an awareness programs to protect themselves or to stop tobacco use 92.7% (3357).

The study revealed that 78.2% (2832) of participants think that teachers who use tobacco were less advisers to their students regarding stopping or not use tobacco products. 49% (1769) of participants think that stopping smoking or tobacco chewing was very difficult.

This study revealed that 76% (2751) of participants agree to prohibit smoking in common public places. (Table 8).

In this study relatives were the main source of knowledge about hazards of tobacco 66.1% (2392) of the students and the second source was TV/radio 60.6% (2196), followed by information took from school 59.3% (2149), News paper & Magazine 46.4% (1679) and mosque 41.1% (1488). (Table 9).
Table No. (1): Distribution of ever and never tobacco use among primary and secondary school students according to gender and school level in Al-Mukalla city.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Ever and never tobacco use</th>
<th>Never Tobacco use at all</th>
<th>Total</th>
<th>$X^2$</th>
<th>O.R</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>Ever tobacco use</td>
<td>Frequency &amp; %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>578 (16%)</td>
<td>1579 (44%)</td>
<td>2157</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>Never tobacco use</td>
<td>Frequency &amp; %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>80 (2%)</td>
<td>1384 (38%)</td>
<td>1464</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>Frequency &amp; %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>658 (18%)</td>
<td>2963 (82%)</td>
<td>3621</td>
<td>266.89</td>
<td>6.33</td>
<td>0.000 (&lt;0.01)</td>
</tr>
</tbody>
</table>

$X^2$ = chi-square.
O.R= odds ratio.

Table No. (2): Distribution of current and never tobacco use during the last 30 days among primary and secondary school students according to gender and school level in Al-Mukalla city.

<table>
<thead>
<tr>
<th>School level</th>
<th>current and never tobacco use during the last 30 days.</th>
<th>Never Tobacco use during last 30 days</th>
<th>Total</th>
<th>$X^2$</th>
<th>OR</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ever tobacco use</td>
<td>Frequency &amp; %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frequency &amp; %</td>
<td>Frequency &amp; %</td>
<td>Frequency &amp; %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>296 (8.2%)</td>
<td>1861 (51.4%)</td>
<td>2157 (59.6%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>5 (0.1%)</td>
<td>1459 (40.3%)</td>
<td>1464 (40.4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>301 (8.3%)</td>
<td>3320 (91.7%)</td>
<td>3621 (100%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$X^2$</td>
<td>204.48</td>
<td>46.41</td>
<td>0.000 (&lt;0.01)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>School level</td>
<td>Primary</td>
<td>132 (3.6%)</td>
<td>2161 (59.7%)</td>
<td>2293 (63.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Secondary</td>
<td>169 (4.7%)</td>
<td>1159 (32%)</td>
<td>1328 (36.7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>301 (8.3%)</td>
<td>2320 (91.7%)</td>
<td>3621 (100%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$X^2$ = chi-square.
O.R= odds ratio.

Table No. (3): Distribution of reasons given by primary and secondary school students who ever tobacco use in Al-Mukalla city.
### Table No. (4): Distribution of reasons given by primary and secondary school students who continues tobacco use in Al-Mukalla city

<table>
<thead>
<tr>
<th>Reasons for Continues Tobacco Use</th>
<th>Frequency (n=301)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addiction</td>
<td>97</td>
<td>31.6%</td>
</tr>
<tr>
<td>Influenced By Friends</td>
<td>93</td>
<td>30.9%</td>
</tr>
<tr>
<td>Just For Fun</td>
<td>84</td>
<td>27.9%</td>
</tr>
<tr>
<td>Overcome Stress</td>
<td>58</td>
<td>19.3%</td>
</tr>
<tr>
<td>*Others</td>
<td>2</td>
<td>2.9%</td>
</tr>
</tbody>
</table>

*Others:
1- Fame (Frequency1=50%).
2- Imitation of movies and series (Frequency1=50%).

### Table No. (5): Distribution of reasons given by primary and secondary school students who never tobacco use in Al-Mukalla city

<table>
<thead>
<tr>
<th>Reasons for never tobacco use</th>
<th>Frequency (n=2964)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forbidden By Islam</td>
<td>1967</td>
<td>66.3%</td>
</tr>
<tr>
<td>Harmful To Health</td>
<td>1695</td>
<td>57.1%</td>
</tr>
<tr>
<td>Social Reasons</td>
<td>823</td>
<td>27.8%</td>
</tr>
<tr>
<td>No Desire</td>
<td>1195</td>
<td>40.3%</td>
</tr>
<tr>
<td>*Others</td>
<td>29</td>
<td>0.9%</td>
</tr>
</tbody>
</table>

*Others:
1- Desire (Frequency 11=40%)
2- Spare time (Frequency 5= 19%)
3- Pride (Frequency 4= 15%)
4- Influenced by parents (Frequency 2= 7%)
5- Good for health (Frequency 2= 7%)
6- Unaware of dangers (Frequency 1= 4%)
7- Imitation (Frequency 1= 4%)
8- Increase pocket money (Frequency 1= 4%)
*Others:*
1. Fair of parents anger (Frequency 5= 17%).
2. No benefits (Frequency 16= 56%).
3. Wasting money (Frequency 3= 10%).
4. Containing toxic materials (Frequency 1=3.4%).
5. Following parents advices (Frequency 1= 3.4%).
6. Not good manner (Frequency 1= 3.4%).
7. Corruption of community (Frequency 1=3.4%).
8. Offensive smells (Frequency 1= 3.4%).

**Table No. (6):** Distribution of passive smoking among primary and secondary school students according to gender and school level in Al-Mukalla city

<table>
<thead>
<tr>
<th>passive smoking</th>
<th>Exposed Frequency &amp; %</th>
<th>Non exposed Frequency &amp; %</th>
<th>Total Frequency &amp; %</th>
<th>X²</th>
<th>OR</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1713 (47.3%)</td>
<td>444 (12.3%)</td>
<td>2157 (59.6%)</td>
<td>22.944</td>
<td>0.65</td>
<td>0.000 (&lt;0.01)</td>
</tr>
<tr>
<td>Female</td>
<td>1254 (34.6%)</td>
<td>210 (5.8%)</td>
<td>1464 (40.4%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2967 (81.9%)</td>
<td>654 (18.1%)</td>
<td>3621 (100%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School level</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>1803 (50%)</td>
<td>490 (13.5%)</td>
<td>2293 (63.3%)</td>
<td>46.23</td>
<td>0.52</td>
<td>0.000 (&lt;0.01)</td>
</tr>
<tr>
<td>Secondary</td>
<td>1164 (32%)</td>
<td>164 (4.5%)</td>
<td>1328 (36.6%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2967 (82%)</td>
<td>654 (18%)</td>
<td>3621 (100%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( X^2 = \) chi-square.
O.R= odds ratio.

**Table No.(7):** Distribution of site of passive smoking among primary and secondary school students according to gender in Al-Mukalla city.
Site of exposure to passive smoking

<table>
<thead>
<tr>
<th>Site of exposure to passive smoking</th>
<th>Male Number (2157)</th>
<th>Female Number (1464)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home</td>
<td>Frequency (%)</td>
<td>Frequency (%)</td>
<td>Frequency %</td>
</tr>
<tr>
<td>School</td>
<td>154 7%</td>
<td>171 12%</td>
<td>325 9%</td>
</tr>
<tr>
<td>Hospital/clinic</td>
<td>114 5%</td>
<td>125 9%</td>
<td>239 7%</td>
</tr>
<tr>
<td>Public Transport Facility</td>
<td>1370 64%</td>
<td>985 67%</td>
<td>2355 65%</td>
</tr>
<tr>
<td>Sport Club</td>
<td>260 12%</td>
<td>25 2%</td>
<td>285 8%</td>
</tr>
<tr>
<td>Total</td>
<td>3621 100%</td>
<td>3621 100%</td>
<td>3621 100%</td>
</tr>
</tbody>
</table>

*Others include:
1. Street (frequency 135=48%).
2. Parks (frequency 32=11%).
3. Markets (frequency 29=10%).
4. Restaurants and cafes (frequency 25=9%).
5. Grocery stores and shops (frequency 21=7%).
6. Hotels (frequency 2=0.7%).
7. Non respond (frequency 39=14%)

Table No. (8): Distribution of attitude regarding tobacco use among primary and secondary school students in Al-Mukalla city.

<table>
<thead>
<tr>
<th>Attitude regarding tobacco use</th>
<th>Answer</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Frequency</td>
<td>%</td>
</tr>
<tr>
<td>1- Tobacco Use Give you confidence In Your Self?</td>
<td>288 8%</td>
<td>3333 92%</td>
</tr>
<tr>
<td>2- Consumers of Tobacco Products Have Many Friends?</td>
<td>1764 48.7%</td>
<td>1857 51.3%</td>
</tr>
<tr>
<td>3- Students must be given awareness Programs to Protect them self or to Stop Tobacco Use?</td>
<td>3357 92.7%</td>
<td>264 7.3%</td>
</tr>
<tr>
<td>4- Teacher who uses tobacco has less advice to their students regarding Stopping or not use tobacco products?</td>
<td>2832 78.2%</td>
<td>789 21.8%</td>
</tr>
<tr>
<td>5- Stopping smoking or tobacco chewing was very difficult?</td>
<td>1769 49%</td>
<td>1852 51%</td>
</tr>
<tr>
<td>6- Do you agree with prohibit Smoking In Common Places?</td>
<td>2751 76%</td>
<td>870 24%</td>
</tr>
</tbody>
</table>
Table No. (9): Distribution of target primary and secondary students according to source of knowledge regarding hazards of tobacco use in Al-Mukalla city

<table>
<thead>
<tr>
<th>Sources of Knowledge</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relatives</td>
<td>2392</td>
<td>66.1%</td>
</tr>
<tr>
<td>School</td>
<td>2149</td>
<td>59.3%</td>
</tr>
<tr>
<td>Mosque</td>
<td>1488</td>
<td>41.1%</td>
</tr>
<tr>
<td>TV/Radio</td>
<td>2196</td>
<td>60.6%</td>
</tr>
<tr>
<td>News Paper &amp; Magazine</td>
<td>1679</td>
<td>46.4%</td>
</tr>
<tr>
<td>Friends</td>
<td>1200</td>
<td>33.1%</td>
</tr>
<tr>
<td>*Others</td>
<td>143</td>
<td>3.9%</td>
</tr>
</tbody>
</table>

*Others:
1. Cigarette packets (frequency 13= 9%).
2. Internet (frequency 23= 16%).
3. Health workers (frequency 12= 8%).
4. Publications (frequency 5= 4%).
5. Smokers (frequency 2= 1%).
6. Lectures or meeting (frequency 7= 5%).
7. Non respond (frequency 81 = 57%).

Figure No. (1): Distribution of primary and secondary school students according to form of tobacco use in Al-Mukalla city.

Figure No. (2): Distribution of primary and secondary school students according to type of tobacco ever use in Al-Mukalla city.
Figure No. (3): Distribution of primary and secondary school students according to type of tobacco current tobacco use in Al-Mukalla city.

Figure No. (4): Distribution of primary and secondary school students according to level of knowledge regarding tobacco use in Al-Mukalla city.
Discussion Tobacco use: The study showed that most of the students never use tobacco by 81.9% (2964) while those who ever use tobacco were 18.2% (658) and only 8.3% (301) were current user.

This result differs from which reported by study in Bihar India among students where there is higher percentage for those who ever use tobacco by 71.8% and current tobacco use by 58.9% and only 28.2% were never use tobacco.\(^{(8)}\)

Time of initiation: Most of student start to smoke between (14-16) year old by 28.8% (126), and between (11-13) year old 27.7% (121) this is similar to study reported in Saudi Arabia among secondary school students where 20-50% of smokers start smoking before 15 year old. While the remaining start after that.\(^{(9)}\) A study reported in United Arab of Emirates by GYTS showed that one in four students who ever smoked cigarette tried smoking at less than ten years which disagree with our study.\(^{(10)}\)

Site of smoking: The most common site of smoking was the public places by 52.2% (226) followed by home 26.5% (115). This is similar to study carried out in Bihar India showed that nearly half of the students 48% smoke in place outside their home,\(^{(8)}\) while study reported in Sudan and study done in Egypt revealed that the most common site was home 22.6% and 21.3% respectively.\(^{(11,12)}\)

Cessation of tobacco use: Most of students who currently smokers they have desire to stop smoking by 73.7% (112) and only 26.3 % (40) they don't. This similar to studies reported in Egypt and UAE by 78.4% and 66.8% respectively.\(^{(12,13)}\) 5.1% of those who are currently chewing tobacco have desire to stop while in study done in Bahrain by GYTS reported that six in ten or 65.3% of currently user want to stop smoking.\(^{(14)}\)
Reasons of use and non use tobacco products: Our results showed that the main reason for starting the use of tobacco was to try 50.2% (325). This is slightly similar to study conducted in Poland among high school student 62.3%, (15) while in the studies conducted among male secondary school student in central region of Saudi-Arabia and India the reason was the influence by friends 63.5 %, 25.5 % respectively (16, 17)

Current users reported that addiction was most common reason for continuation of tobacco 31. 6%, similar to that conducted in pre-university student collage in Bangalore, India 31.3% (17).

Concerning this study the forbidden by Islam was the common reason to never use tobacco 66.3% (1967), the harm to health was the second reason given by students 57.1 % (1695), while in India health effect (harmfulness) was the main reason to never use tobacco 62.1 %. (17)

**Passive smoking:** In this study the majority of students exposed to passive smoking at transport facilities about 65%. This differs from studies conducted in Egypt 46.9% of students were exposed to smoke at public places. (12) The study showed that one third 28% (997) of students exposed to passive smoking at their homes, this is agree with that reported in UAE, and Somali land were the percentage of students exposed to passive smoking at their homes 32.9%, 30.6% respectively (18, 19), while differs from that conducted in Jordon where around two thirds of students exposed to passive smoking at their homes 65%. (20)

**Knowledge and attitude toward tobacco use:** The study showed that those who have known tobacco use is risk factor of cancer were 77%, while 18.9% did not know about it. In Saudi Arabia in the central region among secondary school students were have known tobacco use is risk factor of cancer 84.3%, while 15.7% did not know about it. (16)
This study revealed that those who have known tobacco cause addiction were 70.5% while 13.6% said that tobacco doesn't cause addiction, while a study in Saudi Arabia in the central region among secondary school students said that tobacco use cause addiction 71.5% and 28.5% said that tobacco doesn't cause addiction. (16)

This study showed that those who have known Tobacco use is harmful to health were 84.9% while 9.8% said that tobacco use is not harmful to health, this was slightly similar to study in Saudi Arabia in the central region among secondary school students were have known tobacco is harmful to health 89.3% while 10.7 said that tobacco is not harmful to health. (16)

Regarding the source of knowledge about hazards of tobacco use, our study revealed that relatives were the main source of knowledge 66.1% (2392) which is similar to that reported among School Children in Honduras 59 % (21), while study done among pre university Students in Bangalore- India 43,3 % . (17)

The second source of knowledge in our study was TV & Radio 60, 6 % (2196), while studies conducted in Bangalore, India among pre university Students & Honduras among School Children revealed that the second most common source of knowledge about hazards of Tobacco use was school 43%, 34 % respectively. (17,21)

**Conclusion:** The study indicated that 8.3% of students are current tobacco use. 18.2% of students used tobacco only for one time and main cause was to try (49.4%). Despite accepting passive tobacco smoke as a real risk to health, most of students are exposed to passive smoking (82%) and transport facilities were the most common site of exposure. This indicates the need of sustainable preventive programs to control tobacco use targeting adolescents in schools and increases the importance of activation of legislations for restriction or ban smoking in common public places.
Acknowledgement: We would like to thank Abubakr Bawazir, Afaf Binhareez, Iman Bellasqa, Ashwag Bawazir, Iman Jubran, Iman Binhameed, Hanan Bakoban, Hussein Baashin, Khalid Bamsahell, Mazen Beroqaan, Majeda Binhoodya, Nagat Bafarag, Rania Binthalab and samer Qunzel for the great effort they paid in this study.
References


On Set-Valued Mappings

M. A. Nasser
Dept of mathematics, Collage of Education, Sana’a University (Yemen).

Deapo M. AlRahal
Dept of mathematics, Collage of Business & Economics, Qassim University (kingdom of Saudi Arabia).

Esmail A. M. Alsharabi
Family medicine department
Ministry of Health & population (MOHP) – Hadhramout office.
وجمة الأندلس
للعلوم والتقنية
Alandalus University For Science & Technology
(AUST)
Abstract:

In this work, we discuss several properties and characterizations of continuous set-value mappings, we survey and discuss some weaker forms on this concept, the possibility of dependence of mathematical concepts on the concept of set-value mappings, as linearity, integration, differentiation and measurability etc, also we state and prove some theorems on certain types of set-value mappings.

Mathematics Subject Classification: 54C08, 54C40, 54C60.
Keywords: Multifunctions, m-Multifunctions, Weaker forms of continuity and of C-continuity, Upper and Lower continuity, Upper and Lower -Ccontinuity.
1- Introduction:

Weaker and stronger forms of points play an important role in analysis and topology, by using these points many authors introduced and studied various types of generalizations of sets and so as mappings, also; one of the important and basic topics in theory of classical point set topology and in several branches of mathematics, which has been investigated by many authors, is continuity of functions, this concept has been extended to the setting of set-value mappings. There are several weak and strong variants of continuity of set-value mappings in literature, for instance continuity [95, 127 and 160], strong continuity [6 and 101], super continuity [5], almost and weak continuity [112, 130-131 and 134], nearly and almost nearly continuity [36-37], semi-continuity [18 and 133], α-continuity, almost α-continuity and weak α-continuity [20, 140 and 142], precontinuity and almost precontinuity [154], quasi-continuity and almost quasi-continuity [88, 111, 113, 129, 135 and 141], γ-continuity and almost γ-continuity [3 and 40], δ-semicontinuity and δ-precontinuity [39 and 123], ℓ-continuity and almost ℓ-continuity [65], c-continuity and almost c-continuity [59 and 68], c-quasicontinuous [152] and C-m-continuous of set-value mapping [116], etc.

Moreover, a set-value mappings have many applications in applied mathematics and programming such as, optimal control, calculus of variation, probability, statistics, different inclusions, fixed-point theorems and even in economics, further; the original basic concept of functions represent an essential material for many of mathematical concepts, which the concepts of "Continuity, Differentiability, Integrability and Measurability etc", are begin with function, upbuilds and depends on function, thus functions play significant role in a subjects of mathematics, so the certain authors studied in good many of papers which have been extended much of these concepts to setting
of set-value mappings, that; Y. S. Ledyaev and Q. J. Zhu, in 18 July 2006 introduce and study the concept of "Implicit Multifunction Theorems" [181], in Sep 2009, Chuji Wang, introduce and study the concept of "Fiber Loop Ringdown - a Time-Domain Sensing Technique for Multifunction Fiber Optic Sensor Platforms: Current Status and Design Perspectives" [176],

In Sep. 2002, EFE A. Ok, introduce and study the concept of "Functional Representation of Rotund-Valued Proper Multifunction" [117], in May-June 2002, E. J. Balder and A. R. Sambucini, introduce and study the concept of "On weak compactness and lower closure results for Pettis integrable multifunctions revision" [15].

In 2000, B. Cascales, V. Kadets and J. Rodrgusz, introduce and study the concept of "Measurability And Selection Of Multifunction In Banach Spaces" [25], in 1991, S. Park, J. S. Bae, introduce and study the concept of "On zeros and fixed points of multifunctions with non-compact convex domains" [120], in 2009, Bozena Piatek, introduce and study the concept of "On The Continuity of Integrable Multifunction" [126], in 1995, C. Hess, introduce and study the concept of "On Measurability of Conjugate and Subdifferential of Normal Integrand" [55], in May 2003, E. J. Balder, introduce and study the concept of "Fatou's Lemma for Multifunctions with Unbounded Values in Dual Space" [16], in 2007, C. Zalinescu, A. I. Cuza and O. Mayer, introduce and study the concept of "HahnBanach Extension Theorems for Multifunctions revisited" [183], in 26-1-1972, H. Schirmer, introduce and study the concept of "Homotopy for Small Multifunction" [161], in 2008, Italy, E. Acerbi, G. Crippa and D. Mucci, introduce and study the concept of "A variational problem for couples of functions and multifunctions with interaction between leaves" [4], in 2004, Erdal Ekici, introduce and
study the concept of" On some types of continuous fuzzy multifunction" [38], in 25 Oct 2004.C. Ursescu, introduce and study the concept of "Linear openness of multifunctions in metric spaces" [173], in 1993, S. Park, introduce and study the concept of "Fixed Point Theory Of Multifunctions In Topological Vector Spaces" [121], in 2004, J. Fiser, introduce and study the concept of "Numerical Aspects of Multivalued Fractals" [44], in 1991, D. Averna and G. Bonanno, introduce and study the concept of" Existence of solution for multivalued Boundary Value Problem With Non-convex And Unbounded Right-Hand Side" [13], in 2001, D.Dentcheva, introduce and study the concept of "Approximation, Expansion and Univalued Representation of Multifunction" [34], in 1998, D. Dentcheva, introduce and study the concept of "Regular Castaing Representations Of Multimaps With Applications to Stochastic Programming" [33], in the left hand; the concepts of "Multifunctions And Graphs" and "Multifunctions with Closed Graphs", was study by J. E. Joseph and D. Holý, Trenčín [69 and 172],

Also the concepts of "Weaker form of B*-Continuity for Multimap" and "Upper and Lower NA-continuous Multifunctions" was introduced by D. K. Ganguly & C. Mitra, and by S. Yuksel, T. H. Simsekler and B. Kut [48], And the concept of "Integrability of multifunction" were introduced by R. J. Aumann, [12], a concept of "Differentiability of multifunction" were introduced by F. De Blasi, et al, [11, 31, 32, 74, 119, 159 and 171],…etc.

On the other hand; the concept of minimal structure which introduced by H. Maki in (1996) [84], as set-value mappings defined between two sets and satisfying certain minimal conditions, also in (2001) V. Popa and T. Noiri [149], introduced the concepts of "m-continuous functions" and "upper and lower m-almost continuous setvalued map".
Furthermore; the concept of continuous selection for multifunction which introduced by E. Michael [89-93] was represented a revolution in this area, where the many of mathematics applications could become to be as simulation to that selector single map of set-value map,

The concept of continuous selection, was good idea and useful beginning for studying the many of mathematical concepts, since the selector single-valued function can be represent as an approximation of set-valued map in the way of contraction or in the other ways, thus the mathematical concepts as; differentiation of set-valued maps which are crucial in many applications, and so that a typical set-valued map arising from some construction or variational problem will not be continuous, nonetheless; one often expects the maps to be outer semicontinuous, this however fails in some applications including generalized semi-infinite programming, thus there are a different notions of continuity of set-valued maps, which lead to notion of generalized differentiation of set-valued maps,

In this paper, we introduce and study certain types of continuous set-value map, and we investigate the relationships among another types for set-value mapping, also we give and discuss some studied applications for these types, and we will give some other proposed applications on these concepts. Our essential contribution, we investigate and study new application for set-value map on the concept of homotopy lifting property "H. L. P.", and some applications of known related concepts are also discussed.

In some books or papers a set-valued map from X to Y is denoted by $F : X \to 2^Y$, $F : X \leftrightarrow Y$ or $F : X \Rightarrow Y$, etc, but we exclusively use here the notation $F : X \to Y$,

Furthermore, the terms "set-valued map [11]), point-to-set map [56], correspondences [7], multivalued maps [61, 157-158], multifunction
In this paper, the word spaces mean topological, and the capital letters $F$, $H$, $G$, … are denoted to a set-value mappings, and the small letters $f$, $h$, $g$, … are denoted to a single-mappings, and for a subset $A$ of topological space $(X, \tau)$, $Cl(A)$ and $Int(A)$ represent the closure and interior of $A$ with respect to $\tau$, respectively.

We begin with the following terminologies and notions:

A subset $A$ of $X$ is said to be; $\alpha$-open "resp. semi-open, preopen, $\beta$-open or semi-preopen, $b$-open or $sp$-open or $\gamma$-open", iff; $A \subseteq Int\{Cl[Int(A)]\}$ "resp. $A \subseteq Cl\{Int(A)\}$, $A \subseteq Cl\{Int[Cl(A)]\}$, $A \subseteq Int\{Cl(A)\} \cup Cl\{Int(A)\}" , and for the details of all above concepts; see [1, 8-10, 24, 30, 35, 45, 50, 75-76, 82,84-87, 97-98, 102-106, 108-110, 122-123 and 150-151 and 155]

The family of all semi-open "resp. preopen, $\alpha$-open, $\beta$-open, semi-preopen, $b$-open" sets in X is denoted by $SO(X)$ "resp. $PO(X)$, $\alpha(X)$, $\beta(X)$, $SPO(X)$, $BO(X)$".

For these families, it is shown in [108-Lemm3.1] that $SO(X) \cap PO(X) = \alpha(X)$, since $\alpha(X)$ is a topology for $X$ [103], by $\alpha-Cl(A)$ "resp. $\alpha-Int(A)$" we denote the closure "resp. interior" of $A$ with respect to $\alpha(X)$, the complement of semi-open "resp. preopen, $\alpha$-open" subsets is said to be semi-closed "resp. preclosed, $\alpha$-closed", the intersection of all semi-closed sets of $X$ containing $A$ is called semi-closure [30] of $A$ and is denoted by $sCl(A)$, the union of all semiopen "resp. preopen" subsets of $X$ contained in $A$ is called the semi-interior "resp. preinterior" of $A$ and is denoted by $s-Int(A)$ "resp. preInt(A)", a subset $A$ of $X$ is said to be regular-open "resp. regular closed" if $A = Int\{Cl(A)\}$ "resp. $A = Cl\{Int(A)\}\)" , the family of
regular open "resp. regular closed" subsets of X is denoted by $RO(X)$ "resp. $RC(X)$",

A subset $E$ of $X$ is said to be $\beta$-open [1], iff $E \subseteq Cl\{Int[Cl(E)]\}$, the family of all $\beta$-open subset of $X$ is denoted by $\beta O(X)$.

Also, by recall the definitions of $\theta$-closure and $\delta$-closure due to Velicko [174], that a point $x \in X$ is called $\theta$-cluster "resp. $\delta$-cluster" point of a subset $A \subset X$, iff $Cl(V) \cap A \neq \phi$ "resp. $Int\{Cl(V)\} \cap A \neq \phi$" for every open set $V$ containing $x$, and a set of all $\theta$-cluster "resp. $\delta$-cluster" points of $A$ is called $\theta$-closure "resp. $\delta$-closure" of $A$ and is denoted by $Cl_\theta(A)$ "resp. $Cl_\delta(A)$" [174], a subset $A$ is said to be $\theta$-closed "resp. $\delta$-closed) if $Cl_\theta(A) = A$ "resp. $Cl_\delta(A) = A$", the complement of $\theta$-closed "resp. $\delta$-closed" set is called $\theta$-open "resp. $\delta$-open".

The intersection of all $\theta$-semiclosed sets "resp. semi-closed" of $X$ containing $A$ is called the $\theta$-semiclass $2$ "resp. semiclass $30$" of $A$ and is denoted by $\theta$-S$Cl(A)$ "resp. S$Cl(A)$", the union of all $\theta$-semiopen sets of $X$ contained in $A$ is called $\theta$-semi-interior of $A$ and is denoted by $\theta$-S$Int(A)$, so, a subset $A$ of $X$ is said to be:

- $\delta$-semiopen "resp. $\theta$-semiopen" [2, 39 and 122], iff $A \subseteq Cl\{Int_\delta(A)\}$ "resp. $A \subseteq Cl\{Int_\theta(A)\}\}$",
- $\delta$-preopen "resp. $\theta$-preopen" [35, 123 and 155], iff $A \subseteq Int\{Cl_\delta(A)\}$ "resp. $A \subseteq Int\{Cl_\theta(A)\}\}$",
- $\delta$-sp-open "resp. $\theta$-sp-open" [2 and 54], if $A \subseteq Cl\{Int[Cl_\delta(A)]\}$ "resp. $A \subseteq Cl\{Int[Cl_\theta(A)]\}\}$",

A collection of; $\delta$-semiopen"resp. $\delta$-preopen, $\delta$-sp-open, $\theta$-semiopen, $\theta$-preopen, $\theta$-sp-open" subsets of $X$ are denoted by; $\delta$SO($X$) "resp. $\delta$PO($X$), $\delta$SPO($X$), $\theta$SO($X$), $\theta$PO($X$), $\theta$SPO($X$)" , and these collections are all $m$-structures with property that "the union of any family of subsets belonging to $m_X$, also belongs to $m_X$".
It is known that the families of all \( \delta \)-open and \( \theta \)-open sets of \( X \) are topologies for \( X \).

Also, a subset \( E \subseteq X \) is called \( \alpha \)-paracompact "or strictly paracompact", [21, 67, 83 and 178] iff every cover of \( E \) by open sets of \( X \) is refined by a cover of \( E \) which consists of open sets of \( X \) and is locally finite in \( X \).

For modifications of open sets defined above, the following relationships are known:

\[
\begin{align*}
\theta \text{-open} & \Rightarrow \delta \text{-open} \Rightarrow \text{open} \Rightarrow \alpha \text{-open} \Rightarrow \text{preopen} \Rightarrow \delta \text{-preopen} \Rightarrow \theta \text{-preopen} \\
\downarrow & \quad \downarrow & \quad \downarrow & \quad \downarrow & \quad \downarrow & \quad \downarrow \\
\theta \text{-semi-open} & \Rightarrow \delta \text{-semi-open} \Rightarrow \text{semi-open} \Rightarrow \text{b-open} \Rightarrow \text{sp-open} \Rightarrow \delta \text{-sp-open} \Rightarrow \theta \text{-sp-open}
\end{align*}
\]

2- Preliminaries:

1-2) Definition: [11];

A SV-map \( F : X \to Y \) is a point to set correspondence such that \( F(x) \neq \emptyset \) for all \( x \in X \), on the other hand, for each \( x \in X \), there exist non-empty subset \( F(x) \subseteq Y \),

The "Upper inverse" of a subset \( K \), is define as \( F^+(K) = \{ x \in X : F(x) \subseteq K \} \), and the "Lower inverse" of a subset \( K \), is define as \( F^-(K) = \{ x \in X : F(x) \cap K \neq \emptyset \} \).

A SV-map \( F : X \to Y \) is closed/open, iff an inverse image of any closed/open set is closed/open.
2-2) Definition:
A SV-map $F : X \rightarrow Y$ is called:
- Upper continuous (U. C.) or Upper semi continuous (U. S. C.), iff for all $x \in X$, and for any open $V \subset Y$ contain $F(x)$, there is an open $U \subset X$ contain $x$, such that $F(U) \subset V$.
- Lower continuous (L. C.) or Lower semi continuous (L. S. C.), iff for any $x \in X$, and for any open $V \subset Y$ such that $F(x) \cap V \neq \emptyset$, there is open $U \subset X$ contain $x$, such that $F(U) \cap V \neq \emptyset$.
- Continuous "Semi Continuous" iff $F$ has this property at each point of X.

Note: Some authors, defined the U. S. C., "resp. L. S. C." for SV-map $F$, as; iff $F^+(V) "\text{resp. } F^-(V)"$ is open in X, for any open set $V$ in Y,
- Upper (or Lower) $\alpha$-continuous "U/L. $\alpha$-C. (or L. $\alpha$-C.)" at $x_0 \in X$, iff for all open $V \subset Y$ contain $F(x_0)$ (or $F(x_0) \cap V \neq \emptyset$), there is an open $U \in \alpha O(X)$ contain $x_0$, such that $F(U) \subset V$ (or $F(u) \cap V \neq \emptyset$, for any $u \in U$).
- Upper/lower $\alpha$-continuous (U/L. $\alpha$-C.) at $x_0 \in X$, iff $F$ has this property at all $x \in X$.
- Upper/lower almost continuous (U./L. A. C.), "resp. upper/lower almost $\alpha$-continuous (U./L. A. $\alpha$-C.), upper/lower almost quasi-continuous (U./L. A. q-C.), upper/lower almost pre-continuous (U./L. A. p-C.), upper/lower almost $\beta$-continuous (U./L. A. $\beta$-C.)", at $x_0 \in X$, iff for any open set $V \subset Y$ contain $F(x_0)$ or $F(x_0) \cap V \neq \emptyset$, there is an $U \in O(X, x)$ "resp. $U \in \alpha O(X, x)$, $U \in qO(X, x)$ $U \in PO(X, x)$"
Let $X=Y=\{a, b, c, d\}$, and $\tau_X=\{\emptyset, \{a\}, \{b, c\}, \{a, b, c\}, X\}$, $\tau_Y=\{\emptyset, \{a\}, \{b, d\}, \{a, b, d\}, Y\}$,
Define SV-map \( F : X \to Y \), by \( F(x) = \{ x \} \), \( \forall x \), then \( F \) is upper almost \( \beta \)-continuous but not upper almost \( b \)-continuous, since \( \{ b, d \} \in RO(Y) \) and \( F^*(\{ b, d \}) = \{ b, d \} \) isn't \( b \)-open in \( \tau_X \).

Also, let \( X = \{ a, b, c \} \), \( Y = \{1, 2, 3, 4, 5\} \) and \( \tau_X = \{ \phi, \{ a \}, \{ b \}, \{ a, b \}, X \} \),
\( \tau_Y = \{ \phi, \{ 1, 2 \}, \{ 3, 4 \}, \{ 3, 4, 5 \}, \{ 1, 2, 3, 4 \}, Y \} \),
Define \( F : X \to Y \), by \( F(1) = \{ 1 \} \), \( F(2) = \{3,4,5\} \) and \( F(3) = \{ 2 \} \),
Then \( F \) is upper almost \( b \)-continuous but not upper almost precontinuous .

Also, let \( X = \{1, 2, 3, 4, 5\} \), \( \tau_X = \{ \phi, \{ 1, 2 \}, \{ 3, 4 \}, \{ 3, 4, 5 \}, \{ 1, 2, 3, 4 \}, Y \} \),
Define \( F : X \to Y \), by \( F(1) = \{ 1 \} \), \( F(2) = \{ 3 \} \), \( F(3) = \{ 2 \} \), \( F(4) = \{ 4 \} \), and \( F(5) = \{ 5 \} \),
Then \( F \) is upper almost \( b \)-continuous but not upper almost quasi-continuous.

Also, a SV-map \( F : X \to Y \) is called;

- Upper/Lower \( S \)-almost continuous (U./L. A. C. S.), at \( x_0 \in X \), iff for any open \( V \subset Y \) contain \( F(x_0) \) "or; \( F(x_0) \cap V \neq \phi \)" there is open \( U \subset X \) contain \( x_0 \), such that \( F(x) \subset \text{Int} \{ \text{Cl}(V) \} \), "or; \( F(x) \cap \text{Int} \{ \text{Cl}(V) \} \neq \phi \)", for each \( x \in U \),
- \( S \)-almost continuous (A. C. S.), iff \( F \) has this property at each point of \( X \).
- Upper/lower weakly continuous (U./L. W. C.), at \( x \in X \), iff for any open \( V \) contain \( F(x) \), "or; \( F(x_0) \cap V \neq \phi \)" there is \( U \) contain \( x_0 \), with \( F(x) \subset \text{Cl}(V) \), "or; \( F(x) \cap \text{Cl}(V) \neq \phi \)", for all \( x \in U \).
- Weakly continuous (W. C.) at $x_0 \in X$, iff it has this property at each point of $X$.
- Upper almost weakly continuous (U. A. W. C.) at $x_0 \in X$, "resp. Lower almost weakly continuous (L. A. W. C.) at $x_0 \in X", \text{ iff for any open } V \subseteq Y \text{ contain } F(x_0), \text{ then } x_0 \in \text{Int}\{\text{Cl}(F^+\{\text{Cl}(V)\})\}, "\text{resp. iff for each an open set } V \subseteq Y \text{ where } F(x_0) \cap V \neq \emptyset, \text{ then } x_0 \in \text{Int}\{\text{Cl}(F^-\{\text{Cl}(V)\})\}".
- Almost weakly continuous (A. W. C.) at $x_0 \in X$, iff $F$ has this property at each $x \in X$.
- Upper quasi-continuous "resp. lower quasi-continuous", iff for any $x \in X$, all open $V \subseteq Y$ containing $F(x)$, there is $U \in SO(X, x)$ such that $F(U) \subseteq V$, "resp. iff for any $x \in X$, and all open $V \subseteq Y$ such that $F(x) \cap V \neq \emptyset$, there is $U \in SO(X, x)$, such that $F(u) \cap V \neq \emptyset$ for all $u \in U".

For the above definitions, we put the following remarks and examples; Reciprocally, if $F$ is U. A. C. in $x$, it is obvious U. W. in $x$, as well, If $F$ is L. S-C. in $x$, it is obvious L. W. in $x$, as well, The following implication holds; - U. S-C $\Rightarrow$ U. A. C. $\Rightarrow$ U. W. C. - L. S-C $\Rightarrow$ L. A. C. $\Rightarrow$ L. W. C. The reciprocity is obvious, see [9, 11 and 20],
3-2) **Definition:**

A SV-map $F : X \rightarrow Y$ is called:
- **Upper weakly continuous (U. W. C.)** iff for each $x \in X$ and each open $V$ containing $F(x)$, there exists an open set $U$ containing $x$ such that $F(U) \subset \text{Cl}(V)$,
- **Upper weakly quasi continuous (U. W. q-C.)** iff for all $x \in X$, any open $U$ containing $x$, and any open $V$ containing $F(x)$, there is a nonempty open $G$, where $G \subset U$ and $F(G) \subset \text{Cl}(V)$,
- **Upper almost weakly continuous (U. A. W. C.)** iff for each $x \in X$ and each open $V$ containing $F(x)$, so that $x \in \text{Int}\{\text{Cl}(F^+ \{\text{Cl}(V)\})\}$.
- **Upper $\alpha$-continuous (U. $\alpha$-C.)** at $x \in X$, iff for each open $V$ containing $F(x)$, there exists $U \in \alpha(X, x)$ such that $F(U) \subset V$.
- **Lower $\alpha$-continuous (L. $\alpha$-C.)** at $x \in X$, iff for each open set $V$ such that $F(x) \cap V \neq \emptyset$, there exists $U \in \alpha(X, x)$ such that $F(u) \cap V \neq \emptyset$, for every $u \in U$,
- **Upper/Lower $\alpha$-continuous**, if it is upper (lower) $\alpha$-continuous at all $x \in X$,
- **Upper almost $\alpha$-continuous (U. A. $\alpha$-C.)** at $x \in X$, iff for all $U \in \text{SO}(X, x)$ and all open $V$ containing $F(x)$, there is a nonempty open $G \subset U$, such that $F(G) \subset \text{Cl}(V)$,
- **Lower almost $\alpha$-continuous (L. A. $\alpha$-C.)** at $x \in X$, iff for any $U \in \text{SO}(X, x)$, any open $V$ such that $F(x) \cap V \neq \emptyset$, there is a nonempty open $G \subset U$ with $F(g) \cap \text{Cl}(V) \neq \emptyset$, for all $g \in G$, 

**Definition**: A SV-map $F : X \rightarrow Y$ is called;
- Upper/Lower almost $\alpha$-continuous iff $F$ has this property at every point of $X$.
- Upper weakly $\alpha$-continuous (U. W. $\alpha$-C.) at $x \in X$, iff for all $U \in SO(X, x)$ and any open $V$ containing $F(x)$, there is nonempty open $G \subseteq U$, such that $F(G) \subseteq Cl(V)$,
- Lower weakly $\alpha$-continuous (L. W. $\alpha$-C.) at $x \in X$, iff for all $U \in SO(X, x)$, any open $V$ with $F(x) \cap V \neq \emptyset$, there is a nonempty open $G \subseteq U$, such that $F(g) \cap Cl(V) \neq \emptyset$, for all $g \in G$,
- Upper/Lower weakly $\alpha$-continuous, iff $F$ has this property at every point of $X$,
- Weak* $\alpha$-continuous iff for each open $V \subset Y$; $F^{-1}\{Fr(V)\}$ is $\alpha$-closed, where $Fr(V)$ denotes the frontier of $V$,
- $\alpha$-preopen if for every $U \in \alpha(X)$; $F(U) \subset Int\{Cl[F(U)]\}$.

For a SV-mapping defined above we have the following diagram;

\[
\begin{array}{c}
\text{U. W. quasicontinuous} \\
\uparrow \\
\text{U. } \alpha \text{-continuous} \Rightarrow \text{U. A. } \alpha \text{-continuous} \Rightarrow \text{U. W. } \alpha \text{-continuous} \\
\downarrow \\
\text{U. A. W. continuous,}
\end{array}
\]

- Of course, every A. C. S. SV-map is W. C. SV-map, but the converse is not true in general, so we give the following example:

Let $X=\{a, b, c\}$, $\tau_X=\{\emptyset, \{a\}, \{a, b\}, X\}$ and $Y=\{1, 2, 3\}$, $\tau_Y=\{\emptyset, \{1\}, \{1, 2\}, Y\}$, by define $F : X \to Y$ as; $F(a)=\{1, 3\}$, $F(b)=\{1, 2\}$ and $F(c)=\{3\}$, so that $F$ will be W.C., but not A.C.S.,
- Of course, every W. C. SV-map is A. W. C., but the converse is not true in general, so we give the following example:
Let $X=\{a, b, c\}$, $\tau_X=\{\phi, \{a, b\}, X\}$ and $Y=\{1, 2, 3\}$, $\tau_Y=\{\phi, \{2\}, \{1, 3\}, Y\}$.

We define $F : X \to Y$ as; $F(a)=\{2\}$, $F(b)=F(c)=\{1, 3\}$, so $F$ will be A. W. C., but not W. C.,

For a SV-map $F : X \to Y$, the graph SV-map $G_F : X \to X \times Y$ is defined as $G_F = \{x \times F(x), \ x \in X\}$, and a subset $\{\{x\} \times F(x) : x \in X\} \subseteq X \times Y$, is called a multigraph of $F$ and is denoted by $G(F).

**4-2) Definition:**

A SV-map $F : X \to Y$ is called;

- Upper "or Lower) $\theta$-semicontinuous, iff for any $x \in X$, any open $V \subseteq Y$ such that $x \in F^+(V)$ "or $x \in F^-(V)$", there is $\theta$-semiopen set $U$ containing $x$ such that $U \subseteq F^+(V)$. "or $U \subseteq F^-(V)$",

- U./L. A- $\theta$-semicontinuous, iff for any $x \in X$, any open $V \subseteq Y$, with $x \in F^+(V)$ "or $x \in F^-(V)$", there is $\theta$-semiopen $U$ containing $x$, s. t. $U \subseteq F^+\{\text{Int}[\text{Cl}(V)]\}$, "or $U \subseteq F^-\{\text{Int}[\text{Cl}(V)]\}$",

- Upper/lower weakly $\theta$-semicontinuous, iff for any $x \in X$, any open $V$ with $x \in F^+(V)$, "resp. $x \in F^-(V)$", there is $\theta$-semiopen $U$ containing $x$ with $U \subseteq F^+\{\text{Cl}(V)\}$, "resp. $U \subseteq F^-\{\text{Cl}(V)\}$",

In 1970, Gentry and Hoyle III [51] defined $f : X \to Y$ to be $C$-continuous at $x \in X$ iff for any open $V \subseteq Y$ contain $f(x)$ and having compact complement, there is an open $U \subseteq X$ containing $x$, with $f(U) \subseteq V$, some properties of $C$-continuous function studied by P. Long et al. [80-81 and 118], and in other papers, Neubrunn [100] and Hola et al. [59] extended this notion to the setting of SV-map, In 1991 Lipski [78], introduced the notion of $C$–quasicontinuous SV-map as
generalizing of C-continuous and quasi-continuous SV-map, Some properties of C-quasi-continuous SV-map studied in [152].

In 2008, T. Noiri1 and V. Popa [116], introduced upper/lower C-m-continuous SV-map as SV-map defined on a set satisfying some minimal conditions, so they obtained some characterizations and several properties of such SV-map which turn out unify some results established in [59, 78 and 152], so that; a SV-map $F : X \rightarrow Y$ is called;

- Upper C-continuous (U. C. C.), "resp. upper C-quasicontinuous (U. C. q-C.)", iff for each open subset $V \subseteq Y$ contain $F(x)$ and having compact complement, there exist an open "resp. semi-open" subset $U \subseteq X$ contain $x$, such that $F(U) \subseteq V$,

- Lower C-continuous (L. C. C.), "resp. lower C-quasicontinuous (L. C. q-C.)" at $x \in X$, iff for each open set $V \subseteq Y$ meeting $F(x)$, and have compact complement, there exist an open "resp. semi-open" subset $U \subseteq X$ contain $x$, such that $F(U) \cap V \neq \emptyset$, for each $u \in U$,

- U./L. C-continuous "resp. U./L. C-quasi-continuous", iff $F$ has this property at all $x \in X$.

For the SV-map defined above, the following implications hold:

"U. S. continuous $\Rightarrow$ U. C. continuous $\Rightarrow$ U. C. q-continuous";

"L. S. continuous $\Rightarrow$ L. C. continuous $\Rightarrow$ L. C. q-continuous",

Also, T. Noiri1 and V. Popa [116], defined the following modifications of upper/lower C-continuous SV-map, so that, a SV-map $F : X \rightarrow Y$ is called;
- Upper $C$-$\alpha$-continuous "resp. upper $C$-precontinuous, upper $C$-$b$-continuous, upper $C$-$sp$-continuous" at $x \in X$, iff for all open $V$ contain $F(x)$ and having compact complement, there is $\alpha$-open "resp. preopen, $b$-open, semi-preopen" $U$ contain x, such that $F(U) \subseteq V$,

- L. $C$-$\alpha$-continuous "resp. L. $C$-precontinuous, L. $C$-$b$-continuous, L. $C$-$sp$-continuous" at $x \in X$, iff for any open $V \subseteq Y$ meeting $F(x)$, and have compact complement, there is $\alpha$-open "resp. preopen, $b$-open, semi-preopen" $U \subseteq X$ contain x, s. t. $F(u) \cap V \neq \emptyset$, for each $u \in U$,

- Upper/Lower $C$-continuous "resp. upper/lower $C$-precontinuous, upper/lower $C$-$b$-continuous, upper/lower $C$-$sp$-continuous" if it has this property at each $x \in X$.

For SV-map defined above, the following relationships hold:

"upper semicontinuity $\Rightarrow$ upper $\alpha$-continuity", and;

$$\text{Upper } C\text{-conts } \Rightarrow \text{Upper } C\alpha\text{-conts } \Rightarrow \text{Upper } C\text{-preconts}$$

$$\downarrow \quad \downarrow$$

$$\text{Upper } C\text{-quasi\-conts } \Rightarrow \text{Upper } C\text{-}b\text{-conts } \Rightarrow \text{upper } C\text{-}sp\text{-conts}$$

However, the converse implications are not true in general, and the analogous diagrams holds for the case of "lower".

There are several another types of continuity, so we can given further modifications by similar way, that a definition of any set, will be motivates to new types of these concepts, We enthrone this reviewing by the following modifications conclusions;
5-2) Definition:
A SV-map \( F : X \rightarrow Y \) is called;
- Upper almost \( C \)-continuous (U. A. C.-C.) "resp. Lower almost \( C \)-continuous (L. A. C.-C.)" at \( x \in X \), iff for any open \( V \) with \( F(x) \subseteq V \), and has compact complement, there is open \( U \) with \( x \in U \), such that \( F(U) \subseteq V \), "resp. if for any open \( V \) with \( F(x) \cap V \neq \emptyset \), and has compact complement, there exist an open \( U \subseteq X \) contain \( x \), such that \( F(z) \cap V \neq \emptyset \), for each \( z \in U \)”,
- Almost \( C \)-continuous at \( x \in X \), iff it is both (U. A. C.-C.) and (L. A. C.-C.), at \( x \in X \),
- Almost \( C \)-continuous, iff it is Almost \( C \)-continuous at each \( x \in X \),
- Upper almost \( C \)-semicontinuous (U. A. C. S-C.) at \( x \in X \), iff for any compact \( C \) with \( F(x) \cap C = \emptyset \), there is open \( U \subseteq X \) contain \( x \), such that \( F(z) \cap Cl\{Int\(C\)\} = \emptyset \) for \( z \in U \),
- Lower almost \( C \)-semicontinuous (L. A. C. S-C.) at \( x \in X \), iff whenever \( Y \setminus V \) is compact and \( F(x) \cap V \neq \emptyset \), there is open \( U \) contain \( x \), such that \( F(z) \cap Cl\{Int\(V\)\} \neq \emptyset \), for all \( z \in U \),
- A. C. S-continuous at \( x \in X \), iff it is both (U. A. C. S-C.) and (L. A. C. S-C.), at \( x \in X \),
- Almost C. S-continuous, iff it is Almost C. S-continuous at each \( x \in X \).
It is clear that; \( F \) is U./L. S-continuous, implies that \( F \) is U./L. A. C-continuous, and the following examples shows that these implications are not reversible in general,
Let X and Y be the set of real R, u and τ be the usual and cofinite-topologies on X, Y resp.,
Define the SV-map $F: X \to Y$; as follows:

$$F(x) = \begin{cases} 
\{x\}, & x \not\in \{1,2,\ldots,n\} \\
\{1,2,\ldots,n\}, & x \in \{1,2,\ldots,n\}
\end{cases}$$

Then $F$ is U. A. C-continuous, in fact $F$ is A. C-continuous, but it is not
U./L. S-continuous, because $V=\mathbb{R}\setminus\{1, 2,\ldots, n\} \in \tau$, but not $F^+(V)$ nor $F^+(V)$
belongs to u,

Let $X=\{a, b, c, d\}$, $Y=\{1, 2, 3, 4\}$ and $\tau_x=\{\emptyset, \{a\}, \{b\}, \{a, b\}, \{a, c, d\}, X\}$, $\tau_Y=\{\emptyset, \{1\}, \{1,2\}, Y\}$,

We define $F : X \to Y$ as; $F(a) = \{4\}$, $F(b) = \{1, 2\}$, $F(c) = \{3\}$ and $F(d) = \{4\}$,

So $F$ will be U./L. S-continuous, and hence it is U./L. A. C-continuous, but it is not U./L. A. C. S-continuous at d, note that; $C=\{1, 2, 3\}$ is
compact, and $F(d) \cap C = \emptyset$, $Cl\{Int(C)\} = Y$, so that; there is no $U$ contain
d, such that $F(x) \cap Cl\{Int(C)\} = \emptyset$ for all $x \in U$.

6-2) Definition: see [116],

A SV-map $F : X \to Y$ is called;

- Upper C-0-continuous "resp. upper C-0-precontinuous, upper C-0-
  semicontinuous, upper C-0-sp-continuous" at $x \in X$, iff for any open
  $V$ contain $F(x)$ and $V^C$ is compact, there is 0-open "resp. 0-preopen, 0-
  semiopen, 0-sp-open" $U$ contain x, such that $F(U) \subseteq V$,

- L. C-0-sp-continuous "resp. L. C-0-precontinuous, L. C-0-
  semicontinuous, L. C-0-sp-continuous" at $x \in X$, iff for any open $V$
meeting \( F(x) \), and \( V^C \) is compact, there is \( \theta \)-open "resp. \( \theta \)-preopen, \( \theta \)-semiopen, \( \theta \)-sp-open" \( U \) contain \( x \), such that \( F(u) \cap V \neq \emptyset \), for all \( u \in U \),

- U./L. \( C \)-\( \theta \)-continuous "resp. U./L. \( C \)-\( \theta \)-precontinuous, U./L. \( C \)-\( \theta \)-semicontinuous, U./L. \( C \)-\( \theta \)-sp-continuous", iff this property holds for each \( x \in X \).

- U. \( C \)-\( \delta \)-continuous "resp. U. \( C \)-\( \delta \)-precontinuous, U. \( C \)-\( \delta \)-semicontinuous, U. \( C \)-\( \delta \)-sp-continuous" at \( x \in X \), iff for all \( V \) contain \( F(x) \) and \( V^C \) is compact, there is \( \delta \)-open "resp. \( \delta \)-preopen, \( \delta \)-semiopen, \( \delta \)-sp-open" \( U \subset X \) contain \( x \), where \( F(U) \subset V \),

- L. \( C \)-\( \delta \)-sp-continuous "resp. L. \( C \)-\( \delta \)-precontinuous, L. \( C \)-\( \delta \)-semicontinuous, L. \( C \)-\( \delta \)-sp-continuous" at \( x \in X \), iff for any open \( V \) meeting \( F(x) \), and \( V^C \) is compact, there is \( \delta \)-open "resp. \( \delta \)-preopen, \( \delta \)-semiopen, \( \delta \)-sp-open" \( U \) contain \( x \), such that \( F(u) \cap V \neq \emptyset \), for all \( u \in U \),

- U./L. \( C \)-\( \delta \)-continuous "resp. U./L. \( C \)-\( \delta \)-precontinuous, U./L. \( C \)-\( \delta \)-semicontinuous, U./L. \( C \)-\( \delta \)-sp-continuous", if it has this property for each \( x \in X \).

For the SV-map defined above, the following relationships hold;

\[ \text{U. quasi-continuous} \Leftrightarrow \text{U.} \theta \text{-semicontinuous} \Rightarrow \text{U. almost} \theta \text{-semicontinuous} \Rightarrow \text{U. weakly} \theta \text{-semicontinuous}. \]

The following examples show that these implications are not reversible;

Let \( X = \{ a, b, c \} \), \( \tau_X = \{ \emptyset, \{ a \}, \{ c \}, \{ a, c \}, \{ b, c \}, X \} \),

Define \( F : X \rightarrow X \) by; \( F(a) = \{ a \} \), \( F(b) = \{ b \} \) and \( F(c) = \{ c \} \),
Then $F$ is upper almost $\theta$-semicontinuous, but not upper $\theta$-semicontinuous,
Also, let $X=\{a, b, c, d\}, \tau_X=\{\emptyset, \{a\}, \{a, c\}, \{a, c, d\}, X\},$
Define $F : X \rightarrow X$ by: $F(a)=\{a, b\}, F(b)=\{d\}$ and $F(c)=F(d)=\{a, c, d\},$
Then $F$ is upper weakly $\theta$-semicontinuous, but not upper almost $\theta$-semicontinuous,
And we have the following implications:

$$
\text{U/L C.}\emptyset\text{-conts} \Rightarrow \text{U/L C.}\emptyset\text{-conts} \Rightarrow \text{U/L C.}p\text{-conts} \Rightarrow \text{U/L C.}\emptyset\text{-p.conts} \Rightarrow \text{U/L C.}\emptyset\text{-p.conts} \Rightarrow \text{U/L C.}\emptyset\text{-p.conts}
$$

In (1996), H. Maki [84], introduced the concept of minimal structure defined on a set, In (2001) V. Popa and T. Noiri [148], introduced the concept of $m$-continuous functions, And the concept of upper and lower $m$-almost continuous SV-map, also in [96] we studied the concept of $m$-continuous SV-map and we proved some result in this area.

So that we give the following definition,

**7-2) Definition:**

A subfamily $m_X$ of power set $P(X)$ of nonempty $X$, is called an minimal structure (briefly $m$-structure) on $X$, if $\emptyset \in m_X$, and $X \in m_X,$

Each member of $m_X$ is called $m_X$-open, and their complements is called $m_X$-closed, For any nonempty $X$, the pair $(X, m_X)$ is called $m$-structure space, Let $X$ is a nonempty, and $m_X$ is an $m$-structure on $X$, for a subset $A$ of $X$, the $m_X$-closure

and $m_X$-interior are defined as follows:

- $m_X\text{-Cl}(A)=\cap\{F : A \subseteq F$ and $X - F \in m_X\},$
- $m_X-\text{Int}(A)=\bigcup\{U:U\subseteq A\text{ and }U\in m_X\}$,

**Note:** Let $(X, \tau)$ be a topological space and $A$ is any subset of $X$, if $\tau=m_X$, then;

$$m_X-\text{Cl}(A)=\text{Cl}(A)\text{ and }m_X-\text{Int}(A)=\text{Int}(A),$$

Let $m_X$ be an $m$-structure on nonempty $X$, for a subsets $A, B\subseteq X$, the following are holding:

1) $m_X-\text{Cl}(X-A)=X-\{m_X-\text{Int}(A)\}$, and $m_X-\text{Int}(X-A)=X-\{m_X-\text{Cl}(A)\}$,

2) If $(X-A)\in m_X$, then $m_X-\text{Cl}(A)=A$, and if $A\in m_X$, then $m_X-\text{Int}(A)=A$,

3) $m_X-\text{Cl}(\emptyset)=\emptyset$, $m_X-\text{Cl}(X)=X$, $m_X-\text{Int}(\emptyset)=\emptyset$ and $m_X-\text{Int}(X)=X$,

4) If $A\subseteq B$, then $m_X-\text{Cl}(A)\subseteq m_X-\text{Cl}(B)$, and $m_X-\text{Int}(A)\subseteq m_X-\text{Int}(B)$,

5) If $A\subseteq m_X-\text{Cl}(A)$, and $m_X-\text{Int}(A)\subseteq A$,

6) $m_X-\text{Cl}\{m_X-\text{Cl}(A)\}=m_X-\text{Cl}(A)$, and $m_X-\text{Int}\{m_X-\text{Int}(A)\}=m_X-\text{Int}(A)$.

A minimal structure $m_X$ on nonempty set $X$ is said to be has property "$\rho$", if the union of any family of subsets are belong to $m_X$.

A SV-map $F:(X, m_X)\rightarrow (Y, m_Y)$ is called;

- Upper $m$-continuous, iff for each $x\in X$ and each $V\in m_Y$ containing $F(x)$, there exist $U\in m_X$ containing $x$, such that $F(U)\subseteq V$,

- Lower $m$-continuous, iff for each $x\in X$ and each $V\in m_Y$ such that $F(x)\cap V\neq\emptyset$, there exist $U\in m_X$ containing $x$, such that $F(u)\cap V\neq\emptyset$, for any $u\in U$. 
Note: Let \((X, \tau_1)\) and \((Y, \tau_2)\) be a topological spaces, we put \(\tau=m_X\), then; an upper (lower) \(m\)-continuous \(SV\)-map \(F:(X, m_X)\rightarrow(Y, \tau_2)\) is an upper (lower) continuous \(SV\)-map.

Let \(X\) and \(Y\) be nonempty sets with minimal structure \(m_X, m_Y\) resp., an \(m\)-almost continuous \(SV\)-map, \(F : (X, m_X) \to (Y, m_Y)\) is said to be;

- Upper \(m\)-almost continuous, iff for each \(x\in X\) and any \(V\in m_Y\) containing \(F(x)\), there is \(U\in m_X\) containing \(x\), such that \(F(U)\subseteq m_Y - Int\{(m_Y - Cl(V))\},

- Lower \(m\)-almost continuous, iff for each \(x\in X\) and \(V\in m_Y\) such that \(F(x)\cap V \neq \emptyset\), there is \(U\in m_X\) containing \(x\), where \(F(U)\cap m_Y - Int\{(m_Y - Cl(V))\} \neq \emptyset\), for any \(u\in U\).

Of course, every \(m\)-continuous \(SV\)-map is \(m\)-Almost continuous, but the converse is not true in general, so we have the following example,

Let \(X=\{a, b, c\}, m_X=\{\emptyset, \{a, b\}, \{c\}, X\}\) and \(Y=\{1, 2, 3\}, m_Y=\{\emptyset, \{1\}, \{2\}, \{1, 2\}, Y\}\), so a \(SV\)-map \(F : (X, m_X)\rightarrow(Y, m_Y)\), where \(F(a)\subseteq \{1, 2\}\) and \(F(b)=F(c)=\{3\}\), is; \(M\)-almost continuous \(SV\)-map, but not \(m\)-continuous \(SV\)-map.

A minimal structure on space \(X\) is said to be an \(m\)-semiregular, iff for any \(x\in X\) and \(m_X\)-open \(U\) containing \(x\), there is an \(m_X\)-open \(V\), such that \(x\in V\subseteq m_X - Int\{(m_X - Cl(V))\}\subseteq U\),

Note: An \(m\)-space \((X, m_X)\) is called \(m\)-regular, iff for any \(m_X\)-closed \(F\), and \(x\notin F\), have disjoint \(m_X\)-nbds, in other words, there is two \(m_X\)-open \(U, V\), s. t. \(F\subseteq U, y\in V\) and \(U\cap V=\emptyset\).
Let \( m_X, m_Y \) be a minimal structures on nonempty \( X, Y \) resp., if a SV-map \( F : (X, m_X) \to (Y, m_Y) \) is \( m \)-Almost continuous, where \( Y \) is \( m \)-regular space, then \( F \) is \( m \)-continuous SV-map.

Before giving the next definition, we must point to the following notions,
- A cover of any space \( X \) by an open sets is said to be an open cover,
- A cover of any space \( X \) by an \( m_X \)-open sets is said to be an \( m_X \)-open cover.
- A set \( M \) in topological space \( X \) is called strictly \( m \)-paracompact iff every \( m_X \)-open cover for \( M \) in \( X \) can be refined by locally finite \( m_X \)-open cover in \( X \).

So we have the following definitions modifications;

**8-2) Definition:**

Let \( (X, m_X) \) be an \( m \)-space, a subset \( A \) of \( X \) is said to be; \( m_X \)-b-open iff;

\[
A \subseteq m_X - \text{Cl}(m_X - \text{Int}(A)) \cup \{m_X - \text{Int}[m_X - \text{Cl}(A)]\},
\]

the complement of an \( m_X \)-b-open set is called \( m_X \)-b-closed, the family of all \( m_X \)-b-open sets in \( (X, m_X) \) is denoted by \( m_X \)-b\( O \)(\( X \)).

In particular, the family of all \( m_X \)-b-open of \( (X, m_X) \) containing \( x \in X \) is denoted by \( m_X \)-b\( O \)(\( X, x \)), and the family of all \( m_X \)-b-closed in \( (X, m_X) \) is denoted by \( m_X \)-b\( C \)(\( X \)).

For the above definitions, we give the following remarks and examples,
If \((X,m_X)\) is an \(m\)-space, then every \(m_X\)-open set is \(m_X\)-\(b\)-open, but an \(m_X\)-\(b\)-open set is not necessary to be \(m_X\)-open in general as shown in the following examples,

Let \(X=\{a, b, c\}\) and \(m_X=\{\emptyset, \{a\}, \{b\}, X\}\), so \(\{a, b\}\) is \(m_X\)-\(b\)-open but it is not \(m_X\)-open.

Let \(X=\{a, b, c, d, e\}\) and \(m_X=\{\emptyset, \{a\}, \{e\}, \{c, d\}, X\}\), so \(\{a, b, c\}\) and \(\{b, d, e\}\) are \(m_X\)-\(b\)-open, but \(\{a, b, c\}\cap\{b, d, e\}=\{b\}\) is not \(m_X\)-\(b\)-open.

**9-2) Definition:**

A subset \(N_x\) of \(m\)-space \((X, m_X)\) is said to be \(m_X\)-neighbourhood "resp. \(m_X\)-\(\delta\)-nbd, \(m_X\)-\(\delta\)-pre-nbd, \(m_X\)-\(b\)-nbd" of an point \(x\in X\) if there exists a \(m_X\)-open "resp. \(m_X\)-\(\delta\)-open, \(m_X\)-\(\delta\)-preopen, \(m_X\)-\(b\)-open" set \(U\), such that \(x\in U\subseteq N_x\).

Let \((X, m_X)\) be an \(m\)-space and a subset \(A\subseteq X\), the \(m_X\)-\(b\)-closure of \(A\), denoted by \(m_X\)-\(b\)\(\text{-Cl}(A)\), and the \(m_X\)-\(b\)-interior of \(A\), denoted by \(m_X\)-\(b\)-\(\text{Int}(A)\), are defined, respectively, as;

- \(m_X\)-\(b\)-\(\text{Cl}(A)\)=\(\cap\{U : X-U\in m_X\text{-}bO(X), A\subseteq U\}\),
- \(m_X\)-\(b\)-\(\text{Int}(A)\)=\(\cup\{W : W\in m_X\text{-}bO(X), W\subseteq A\}\).

Also, we need to the following definition;

**10-2) Definition:** see [125 and 175],

A subset \(H\) of \(m\)-space \((X, m_X)\) is said to be \(m_X\)-regular open "resp. \(m_X\)-preopen", iff \(H= m_X\text{-}\text{Int}(m_X\text{-}\text{Cl}(H))\) "resp. \(H\subseteq m_X\text{-}\text{Int}\{m_X\text{-}\text{Cl}(H)\}\)",

the complement of an \(m_X\)-regular open "resp. \(m_X\)-preopen" set is said to be \(m_X\)-regular closed "resp. \(m_X\)-preclosed",

Let \(A\) be a subset of \(m\)-space \((X, m_X)\);
The intersection of all $m_X$-preclosed sets of $X$ containing $A$ is called $m_X$-preclosure of $A$ and is denoted by $m_X\text{-pCl}(A)$, and the union of all $m_X$-preopen sets of $X$ contained in $A$ is called $m_X$-preinterior of $A$ and is denoted by $m_X\text{-pInt}(A)$.

Let $A$ be a subset of $m$-space $(X, m_X)$;

- The union of all $m_X$-regular open sets of $X$ contained in $A$ is called $m_X$-$\delta$-interior of $A$ and is denoted by $m_X\text{-}\delta\text{Int}(A)$.
- A subset $A \subseteq X$ is called $\delta$-open, iff $A = m_X\text{-}\delta\text{Int}(A)$, the complement of $\delta$-open is $\delta$-closed.

A subset $H$ of $m$-space $(X, m_X)$ is called $m_X$-$\delta$-preopen, iff $H \subseteq m_X\text{-}\text{Int}\{m_X\text{-}\delta\text{Cl}(H)\}$, the complement of $m_X$-$\delta$-preopen is called $m_X$-$\delta$-preclosed.

Let $A$ be a subset of $m$-space $(X, m_X)$;

- The intersection of all $m_X$-$\delta$-preclosed of $X$ containing $A$ is called $m_X$-$\delta$-preclosure of $A$ and is denoted by $m_X\text{-}\delta\text{pCl}(A)$.
- The union of all $m_X$-$\delta$-preopen of $X$ contained in $A$ is called $m_X$-$\delta$-preinterior of $A$ and is denoted by $m_X\text{-}\delta\text{pInt}(A)$.

Let $F : (X, m_X) \rightarrow (Y, \sigma)$, of $m$-space $(X, m_X)$ to topological space $(Y, \sigma)$, so $F$ is said to be:

- Upper $\delta$-$m$-precontinuous at $x \in X$, iff for each open $V$ containing $F(x)$, there exists an $m_X$-$\delta$-preopen set $U$ containing $x$, such that $F(U) \subseteq V$. 

- Lower $\delta$-$m$-precontinuous at $x \in X$ iff for each open $V$ such that $F(x) \cap V \neq \emptyset$, there exists an $m_X$-$\delta$-preopen $U$ containing $x$, such that $F(z) \cap V \neq \emptyset$ for every $z \in U$,

- Upper/Lower $\delta$-$m$-precontinuous, iff $F$ has this property at each point of $X$.

- Upper almost $\delta$-$m$-precontinuous at $x \in X$, iff for each open $V$, such that $x \in F^+(V)$, there exists an $m_X$-$\delta$-preopen $U$ containing $x$, such that $U \subseteq F^+\{\text{Int}[\text{Cl}(V)]\}$,

- Lower almost $\delta$-$m$-precontinuous at $x \in X$, iff for each open $V$, such that $x \in F^-(V)$, there exists an $m_X$-$\delta$-preopen $U$ containing $x$, such that $U \subseteq F^-\{\text{Int}[\text{Cl}(V)]\}$,

- Upper/Lower almost $\delta$-$m$-precontinuous, iff $F$ has this property at all point of $X$.

A SV-map $F : (X, m_X) \rightarrow (Y, \sigma)$, of $m$-space $(X, m_X)$ into topological space $(Y, \sigma)$, is called;

- Upper $b$-$M$-continuous at $x \in X$, iff for any open $V \in Y$ such that $F(x) \subseteq V$, there exist $U \in m_X$-$bO(X, x)$ such that $F(U) \subseteq V$,

- Lower $b$-$M$-continuous at $x \in X$, iff for each open $V \in Y$ such that $F(x) \cap V \neq \emptyset$, there exists $U \in m_X$-$bO(X, x)$ such that $F(u) \cap V \neq \emptyset$, for every $u \in U$,

- And $F$ is called upper/lower $b$-$M$-continuous if $F$ is upper/lower $b$-$M$-continuous for all $x \in X$. 
For the above definitions, we give the following examples;
Let $X=\{a, b, c\}$ and $Y=\{1, 2\}$, define $m_X=\{\emptyset, \{a\}, \{b\}, \{a, c\}, \{b, c\}, X\}$, and $\sigma_Y=\{\emptyset, \{1\}, Y\}$, so a SV-map $F : (X, m_X)\rightarrow (Y, \sigma)$ which defined as; $F(a)=F(b)=\{2\}$ and $F(c)=Y$, is to be upper $b-M$-continuous.

Let $X=\{a, b, c\}$ and $Y=\{1, 2\}$, define minimal structure $m_X=\{\emptyset, \{a\}, \{b\}, \{a, c\}, \{b, c\}, X\}$ on $X$, and a topology $\sigma_Y=\{\emptyset, \{1\}, Y\}$ on $Y$, so a SV-map $F : (X, m_X)\rightarrow (Y, \sigma)$ which defined as; $F(a)=F(b)=Y$ and $F(c)=\{1\}$, is to be lower $b-M$-continuous.

Also, a SV-map $F : (X, m_X)\rightarrow (Y, \sigma)$, is said to be;

- Upper almost $b-M$-continuous at $x\in X$, iff for each open set $V\in Y$ such that $x\subseteq F^+(V)$, there exists $U\in m_X-bO(X, x)$ such that $U\subseteq F^+\{\text{Int}[\text{Cl}(V)]\}$, and $F$ is called upper almost $b-M$-continuous if $F$ is upper almost $b-M$-continuous for all $x\in X$.

- Lower almost $b-M$-continuous at $x\in X$, iff for each open $V\in Y$ such that $x\subseteq F^-(V)$, there exists $U\in m_X-bO(X, x)$ such that $U\subseteq F^+\{\text{Int}[\text{Cl}(V)]\}$, and $F$ is called lower almost $b-M$-continuous if $F$ is lower almost $b-M$-continuous for all $x\in X$.

For the above definitions, we give the following remarks and examples;
"U. $b-M$-continuous $\Rightarrow$ U. A. $b-M$-continuous",
But this implication is reversible, so we give the following example;
Let $X=\{a, b, c, d\}$ and $Y=\{1, 2, 3\}$, with $m_X=\{\emptyset, \{c\}, \{d\}, X\}$, and $\sigma_Y=\{\emptyset, \{1\}, Y\}$, so a SV-map $F : (X, m_X)\rightarrow (Y, \sigma)$ which defined as;
\( F(a) = \{1\}, \ F(b) = \{1, 2\} \) and \( F(c) = F(d) = Y \), is to be upper almost \( b-M \)-continuous, but it is not upper \( b-M \)-continuous.

Also, we have that: \"L. \( b-M \)-continuous \( \Rightarrow \) L. A. \( b-M \)-continuous\".

But this implication is reversible, so we give the following example:
Let \( X = \{a, b, c, d\} \) and \( Y = \{1, 2, 3\} \), with \( m_X = \{\emptyset, \{c\}, \{d\}, X\} \), and \( \sigma_Y = \{\emptyset, \{1\}, Y\} \), so a SV-map \( F : (X, m_X) \rightarrow (Y, \sigma) \) which defined as; \( F(a) = \{1\}, F(b) = Y \) and \( F(c) = F(d) = \{2, 3\} \), is to be lower almost \( b-M \)-continuous but it is not lower \( b-M \)-continuous.

For a SV-map \( F \), defined above, the following implication hold:
"Upper \( \delta-m \)-precontinuity \( \Rightarrow \) Upper almost \( \delta-m \)-precontinuity"

Note that none of these implication is reversible, so we give the following example:
Let \( X = \{a, b, c\} \) and \( Y = \{1, 2, 3, 4, 5\} \), with \( m_X = \{\emptyset, \{b\}, \{c\}, \{b, c\}, X\} \) and \( \tau_Y = \{\emptyset, \{1, 2, 3, 4\}, Y\} \), define \( F : (X, m_X) \rightarrow (Y, \sigma) \), by \( F(a) = \{3\}, F(b) = \{2, 4\} \) and \( F(c) = \{1, 5\} \), then \( F \) is U. A. \( \delta-m \)-pre-continuous, but not U. \( \delta-m \)-precontinuous, since \( \{1, 2, 3, 4\} \in \tau_Y \), and \( F^+(\{1, 2, 3, 4, 5\}) = \{a, b\} \) is not \( m_X \)-\( \delta \)-preopen in \( X \).

3- Main results:

In this section, we discuss and prove some results on the concept of U/L. \( \delta-m \)-pre-continuous, we begin with the following four theorems which due to the E. Ekici [40], that he collect many of important basic terms for the generalize forms of SV-map.
1-3) Theorem: [39],
Let $F : X \rightarrow Y$ be a SV-map, then the following statements are equivalent;
1- $F$ is U. A. $\delta$-semicontinuous SV-map,
2- $F^+\{\text{Int} [\text{Cl}(V)]\} \in \delta$-SO(X), for any open $V \subseteq Y$,
3- $F^-\{\text{Cl}[\text{Int}(K)]\} \in \delta$-SC(X), for any closed $K \subseteq Y$,
4- $F^+(G) \in \delta$-SO(X), for any regular open $G \subseteq Y$,
5- $F^-(E) \in \delta$-SC(X), for any regular closed $E \subseteq Y$,
6- For all $x \in X$, any open $V$ and $F(x) \subseteq V$, there is $\delta$-semiopen $U$ and $x \in U$, such that $F(U) \subseteq S.CI(V)$,
7- $F^+(V) \subseteq \delta$-S.Int$\{F^+\{S.CI(V)\}\}$, for all open $V \subseteq Y$,
8- $\delta$-S.CI$\{F^-[S.Int(K)]\} \subseteq F^-(K)$, for all closed $K \subseteq Y$,
9- $\delta$-S.CI$\{F^-(Cl[Int(K)])\} \subseteq F^-(K)$, for all closed $K \subseteq Y$,
10- $\delta$-S.CI$\{F^-(V)\} \subseteq F^-\{Cl(V)\}$, for each $V \in bO(Y)$,
11- $\delta$-S.CI$\{F^-(V)\} \subseteq F^-\{Cl(V)\}$, for each $V \in S.O(Y)$,
12- $F^+(V) \subseteq \delta$-S.Int$\{F^+\{\text{Int}[\text{Cl}(V)]\}\}$, for every $V \in pO(Y)$,

2-3) Theorem: [39],
Let $F : X \rightarrow Y$ be a SV-map, then the following statements are equivalent;
1- $F$ is L. A. $\delta$-semicontinuous SV-map,
2- $F^-\{\text{Int}[\text{Cl}(V)]\} \in \delta$-SO(X), for any open $V \subseteq Y$,
3- $F^+\{\text{Cl}[\text{Int}(K)]\} \in \delta$-SC(X), for any closed $K \subseteq Y$,
4- $F^-(G) \in \delta$-SO(X), for any regular open $G \subseteq Y$,
5- $F^+(E) \in \delta$-SC(X), for any regular closed $E \subseteq Y$, 

6- For all $x \in X$, any open $V$ with $F(x) \cap V \neq \emptyset$, there is $\delta$-open $U$ and $x \in U$, s. t. $F(u) \cap S.Cl(V) \neq \emptyset$.

7- $F^{-}(V) \subseteq \delta$-$S.Int\{F^{-}\{S.Cl(V)\}\}$, for all open $V \subseteq Y$.

8- $\delta$-$S.Cl\{F^{+}[S.Int(K)]\} \subseteq F^{+}(K)$, for all closed $K \subseteq Y$.

9- $\delta$-$S.Cl\{F^{+}(Cl[Int(K)])\} \subseteq F^{+}(K)$, for all closed $K \subseteq Y$.

10- $\delta$-$S.Cl\{F^{+}(V)\} \subseteq F^{+}\{Cl(V)\}$, for each $V \in bO(Y)$.

11- $\delta$-$S.Cl\{F^{+}(V)\} \subseteq F^{+}\{Cl(V)\}$, for each $V \in S.O(Y)$.

12- $F^{-}(V) \subseteq \delta$-$S.Int\{F^{-}\{Int[Cl(V)]\}\}$, for every $V \in pO(Y)$.

**3-3) Theorem: [39],**

Let $F : X \to Y$ be a SV-map, then the following statements are equivalent;

1- $F$ is U. W. $\delta$-semicontinuous SV-map,

2- For each $x \in X$ and each open $V$ containing $F(x)$, there exists an $\delta$-semiopen $U$ containing $x$, such that $F(U) \subseteq Cl(V)$,

3- $F^{+}(V) \subseteq Cl\{\delta$-$Int\{F^{+}[Cl(V)]\}\}$, for any open $V \subseteq Y$.

4- $Int\{\delta$-$Cl\{F^{-}(V)\}\} \subseteq F^{-}\{Cl(V)\}$, for any open $V \subseteq Y$.

5- $Int\{\delta$-$Cl\{F^{-}[Int(K)]\}\} \subseteq F^{-}(K)$, for any closed $K \subseteq Y$.

6- $\delta$-$S.Cl\{F^{-}[Int(K)]\} \subseteq F^{-}(K)$, for any closed $K \subseteq Y$.

7- $\delta$-$S.Cl\{F^{-}(Int[Cl(E)])\} \subseteq F^{-}\{Cl(E)\}$, for any subset $E \subseteq Y$.

8- $F^{+}\{Int(E)\} \subseteq \delta$-$S.Int\{F^{+}(Cl[Int(E)])\}$, for subset $E \subseteq Y$.

9- $F^{+}(V) \subseteq \delta$-$S.Int\{F^{+}[Cl(V)]\}$, for any open $V \subseteq Y$.

10- $\delta$-$S.Cl\{F^{-}(V)\} \subseteq F^{-}\{Cl(V)\}$, for any open $V \subseteq Y$. 
4-3) **Theorem:** [39],

Let $F : X \rightarrow Y$ be a SV-map, then the following statements are equivalent;

1- $F$ is L. W. $\delta$-semicontinuous SV-map,
2- For each $x \in X$ and each open $V$ such that $F(x) \cap V \neq \emptyset$, there exists an $\delta$-semiopen $U$ containing $x$, such that if $y \in U$, then $F(y) \cap Cl(V) \neq \emptyset$,
3- $F^{-}(V) \subseteq Cl\{\delta-Int(F^{-}[Cl(V)])\}$, for any open $V \subset Y$,
4- $Int\{\delta-Cl(F^{+}(V))\} \subseteq F^{+}\{Cl(V)\}$, for any open $V \subset Y$,
5- $Int\{\delta-Cl(F^{+}[Int(K)])\} \subseteq F^{+}(K)$, for any closed $K \subset Y$,
6- $\delta-S.Cl\{F^{+}[Int(K)]\} \subseteq F^{+}(K)$, for any closed $K \subset Y$,
7- $\delta-S.Cl\{F^{+}(Int[Cl(E)])\} \subseteq F^{+}\{Cl(E)\}$, for any subset $E \subset Y$,
8- $F^{-}\{Int(E)\} \subseteq \delta-S.Int\{F^{-}[Cl[Int(E)])\}$, for subset $E \subset Y$,
9- $F^{-}(V) \subseteq \delta-S.Int\{F^{-}[Cl(V)])\}$, for any open $V \subset Y$,
10- $\delta-S.Cl\{F^{+}(V)\} \subseteq F^{+}\{Cl(V)\}$, for any open $V \subset Y$,

In the end of this section we state and prove the following four theorems, but in beigen we need to the following lemma,

5-3) **Lemma:** [112],

For a SV-map $F : X \rightarrow Y$, and any subsets $A \subset X$, $B \subset Y$, the following assertions hold:

1- $G_{F}^{+}(A \times B) = A \cap F^{+}(B)$,
2- $G_{F}^{-}(A \times B) = A \cap F^{-}(B)$.

6-3) **Theorem:**
Let $F : X \rightarrow \prod_{i \in I} X_i$ be SV-map from topological space $X$ to product space $\prod_{i \in I} X_i$ and let $P_i : \prod_{i \in I} X_i \rightarrow X_i$ be the projection for all $i \in I$, so if $F$ is U/L. $\delta$-$m$-precontinuous, then $P_i \circ F$ is U/L. $\delta$-$m$-precontinuous SV-map for each $i \in I$.

**Proof:**

We shall prove this only for the upper case, and the lower case is similar,

Let $V_i$ be an open in $X_i$, since $P_i(V_i \times \prod_{i \in I} X_i)$ is open, so take $\{P_i \circ F\}(x) \subset P_i(V_i \times \prod_{i \in I} X_i)$,

Since $\{P_i \circ F\}(x) = P_i\{F(x)\}$, and $F$ is U. $\delta$-$m$-$p$-continuous, also $P_i$ is continuous,

So that; there exists an $m_X$-$\delta$-preopen set $U$ containing $x$, such that $F(U) \subset V_i \times \prod_{i \in I} X_i$,

And hence; $\{P_i \circ F\}(U) \subset P_i(V_i \times \prod_{i \in I} X_i)$, then $F \circ P_i$ is U. $\delta$-$m$-precontinuous SV-map.

7-3) Theorem:

Let $F : X \rightarrow Y$ be multifunction, and $E$ be an $m_X$-$\delta$-open set in $X$, if $F$ is U/L. $\delta$-$m$-precontinuous, so the restriction SV-map $F|E : E \rightarrow Y$ is U/L. $\delta$-$m$-precontinuous.

**Proof:**

Suppose that $V$ is an open in $Y$, let $x \in E$ and $F(x) \subset V$,

Since $F$ is U. $\delta$-$m$-precontinuous, it follows that there exists an $m_X$-$\delta$-preopen $G$, 

where \( x \in G \) and \( F(G) \subseteq V \), so that \( x \in G \cap E \in \delta-m_X-pO(E) \), and \( \{ F[E] \}(G \cap E) \subseteq V \),

Thus, we show that the restriction SV-map \( F|E \) is U. \( \delta-m \)-precontinuous,

The proof of the lower case is similar to that given above.

8-3) Theorem:

Let \( F : X \to Y \) be multifunction, if the graph SV-map of \( F \) is U/L. \( \delta-m \)-precontinuous, then \( F \) is U/L. \( \delta-m \)-precontinuous.

Proof:

Suppose that \( G_F : X \to Y \times Y \) is U. \( \delta-m \)-precontinuous, \( x \in X \) and \( V \) be any open of \( Y \) containing \( F(x) \), Since \( X \times V \) is open in \( X \times Y \) and \( G_F(x) \subseteq X \times V \), there is \( U \in m_X-\delta-pO(X, x) \) such that \( G_F(U) \subseteq X \times V \), and we have \( U \subseteq G_F^+(X \times V) = X \cap F^+(V) = F^+(V) \) "by Lemma 5-3",

So \( F(U) \subseteq V \), which shows that \( F \) is U/L. \( \delta-m \)-precontinuous.

The proof of the lower case is similar to that given above.

9-3) Theorem:

Suppose that \( F_1 : X \to Y \) and \( F_2 : X \to Z \) are SV-map, let \( F_1 \times F_2 : X \to Y \times Z \) be a SV-map which defined by \( \{ F_1 \times F_2 \}(x) = F_1(x) \times F_2(x) \),

for all \( x \), if \( F_1 \times F_2 \) is U/L. W. \( \delta \)-precontinuous, then \( F_1 \) and \( F_2 \) is U/L. W. \( \delta \)-precontinuous.

Proof:

Let \( x \in X \) and \( V_1, V_2 \) be any open sets of \( Y, Z \) resp., with \( x \in F_1^+(V_1) \) and \( x \in F_2^+(V_2) \),

Such that; \( F_1(x) \subseteq V_1 \), \( F_2(x) \subseteq V_2 \), hence \( F_1(x) \times F_2(x) = \{ F_1 \times F_2 \}(x) \subseteq V_1 \times V_2 \),
And thus; \( x \in \{ F_1 \times F_2 \}^+ (V_1 \times V_2) \), it follows that there exists \( \delta \)-preopen \( U \) containing \( x \) such that \( U \subseteq \{ F_1 \times F_2 \}^+ [Cl(V_1 \times V_2)] \), we obtain that

\[
U \subseteq F_1^+ \{ Cl(V_i) \} \quad \text{and} \quad U \subseteq F_2^+ \{ Cl(V_2) \},
\]

Therefore \( F_1 \) and \( F_2 \) is U. W. \( \delta \)-precontinuous.

The proof of the lower case is similar to that presented above.
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