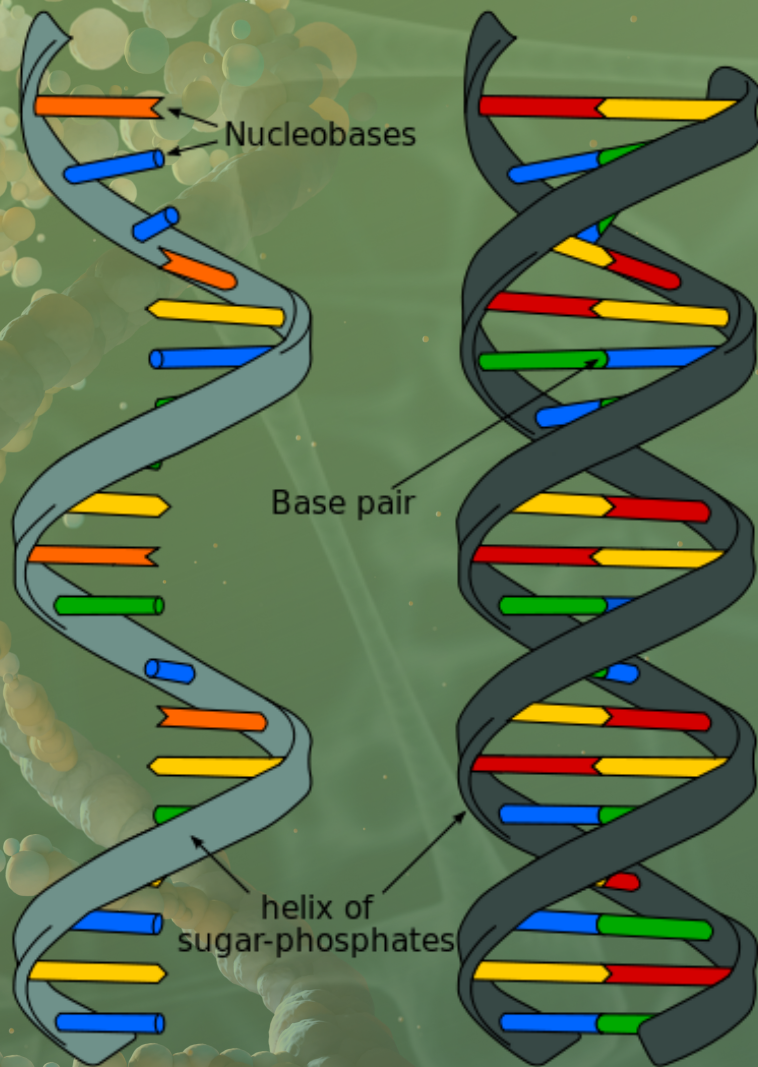
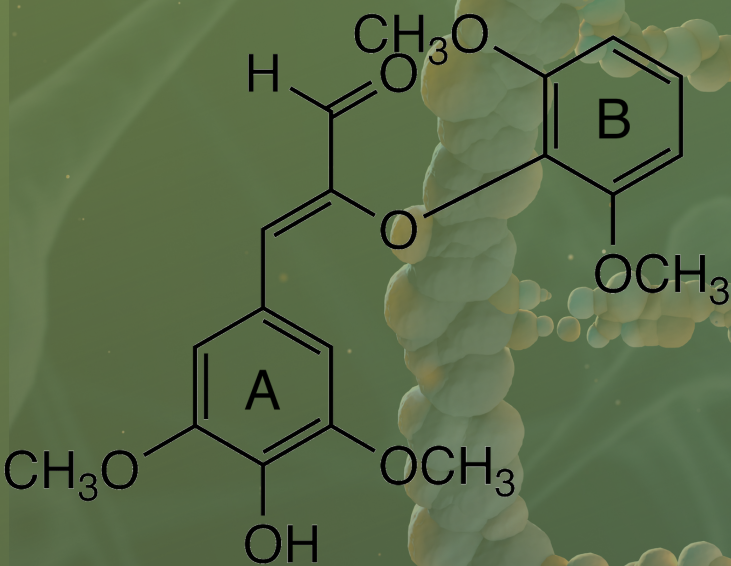
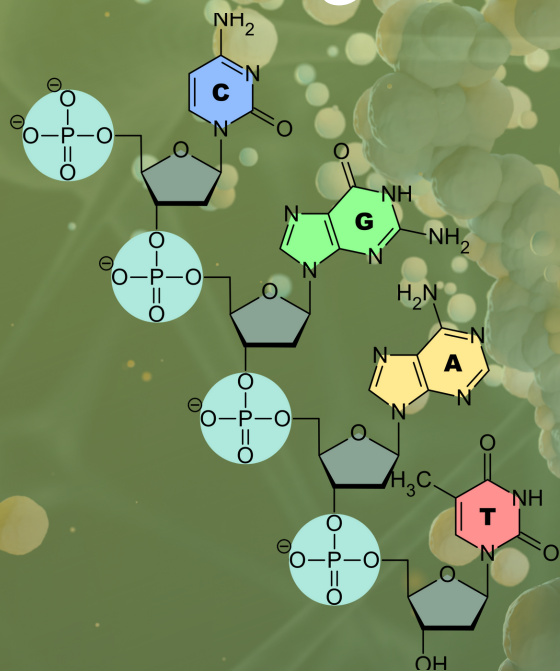




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ADVANCES IN SCIENCE, TECHNOLOGY AND ENGINEERING SYSTEMS JOURNAL

Volume 2 Issue 2

March-April 2017

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Effects of the Metropolitan Civil Resilience Program: Comparison of the SAT Resilience Program and an Exercise Program

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ARTICLE INFO

Article history:

Received: 12 December, 2016

Accepted: 30 January, 2017

Online: 25 February, 2017

Keywords:

resilience

self-image

SAT (Structured Association Technique)

ABSTRACT

Purpose: To conduct preliminary research for developing a program to enhance resilience, a topic that has generated attention of late.

Methods: We compared the Structured Association Technique (SAT) resilience program and an exercise program. The citizen's lecture on stress management occurred 1 month after East Japan Earthquake, and the intervention was carried out in the afternoon of the same day. Participants could choose to join SAT (an imagery therapy to improve the self-image using associative images) resilience program (17 people) or healthy exercise program (Shakkiri gymnastics program; 9 people). They were metropolitan area residents, including workers and families. Participants filled in the checklist before the intervention, immediately after the intervention, and 1 month later. The saliva of all participants was extracted to assess SIgA as an immunity index before and immediately after the intervention. We compared the SAT group (9 females, age 34–60) and the exercise group (9 females, age 32–57).

Results: Compared to the exercise group, mental health indices such as self-solving and significantly improved in the SAT group. However, this does not suggest that there was no improvement in the exercise group. After intervention, in the exercise group, SIgA in saliva and depression improved. In the group, the immunity index shown in SIgA in the saliva, the mental health index as measured by state anxiety and depression, the self-image index as measured by self-affirmation, problem-solving, moral independence, and perceived family support all significantly improved.

Considerations: It appears that, through the change in self-image, resilience in daily life was promoted by the resilience program.

1. Introduction

The Japanese economy grew steadily before the 'Bubble economy' collapsed in the early 1990s. However, during the 1990s, it stopped growing. This situation induced extreme stress in society, leading to worsened mental health. Accordingly, suicides increased starting in the late 90s. Since 1998, there have been over 30,000 suicides over 14 years [1]. According to a survey by the Metropolitan Police Department, among cases with a document clearly indicating the cause of the suicide, about 47% were preceded by health problems, including mental health. In response,

what is required of us is neither healing nor escaping from stress [2]. Rather, what is required is enhancing resilience to stress and learning from it, and then proactively changing the situation.

1.1. Resilience

The concept of resilience has drawn recent attention for various reasons. Resilience refers to the ability to recover from stress and fight against stress to improve the situation. Resilience is a term derived from physics originally used to reflect 'elasticity and repulsion.' In the 1970s, the study of resilience began in child psychiatry. Those with a healthy personality, despite having an adverse childhood, were considered highly resilient [3]. The study

of resilience has now spread to recovery from war experience and post-traumatic stress disorder (PTSD) resulting from natural disasters like earthquakes and typhoons. It refers not only to recovery of normal mental health status, but the ability to fight against stresses, overcome, learn, and then change the situation [4-7].

How a person recognizes a stressful situation will in part determine whether the resulting state is despair or growth. Self-image, that is, how one thinks and feels about the self, is a critical point here [8].

Munakata suggests that “self-image is the immobilized past memory of experience with self-interpretation and the memory synchronized with the self” and “a belief of self-image is named self-image script.” He says that self-image determines the perspective for interpreting a stressful situation. High resilience to one’s self-image is associated with high self-affirmation [9], problem-solving [10], self-expression, independence [11], and reduced depression [12].

2. Methods

2.1. Recruitment of participants

Participants were recruited from a metropolitan area, especially around Bunkyo-ku in Tokyo, and an announcement was created in some local newspapers. The citizen lecture on stress management was carried out at public facility A in Bunkyo-ku, Tokyo, 1 month after the Great East Japan Earthquake. There were 56 participants. After the lecture, we introduced the SAT resilience program and the Shakkiri exercise program as stress management programs. We asked participants to join the program in advance, and 55 participants were pre-registered on March 11, 2011. The intervention seminars took place in conference rooms A and B in the same public facility from 13:00 to 15:00.

2.2. Intervention subjects

There were 17 participants (3 male, 14 female) in the SAT resilience program (SAT group), and 9 (9 female) in the exercise program (Shakkiri exercise). Participants ranged from 21 to 78 years old, and participation rate from the civic lecture was 47.3%. Participants selected one of the stress management programs.

2.3. Intervention protocol

1. Intervention preparation (30 min)

First, all subjects assembled in conference room A. We announced a brief description of the programs and asked the subjects to sign a consent form. Second, centrifuge tubes were given to each subject, and their saliva was collected. Each participant then answered an anonymous psychological questionnaire with a unique number. Collected saliva samples were closed and stored in a polystyrene foam box with ice packs immediately to be sent for professional biochemical examination (SRL Co., Ltd) on the same day. Each subject had two centrifuge tubes for saliva collection and signed with their unique number and name by Katakana for saliva examination. We marked the collected centrifuge tubes to indicate pre-/post-intervention when tubes were collected. Immediately after the seminar, the box was sent for saliva examination. Delivery was specified for the next day.

2. SAT resilience program (1 hour)

The SAT resilience improvement sheet and the surrogate facial representative list were given to subjects in the conference room A. SAT therapy developer lectured on the SAT resilience program with these documents. He demonstrated image work modeling exercise with the resilience improvement sheet, and later, all subjects practiced the image work modeling exercises.

3. Shakkiri exercise program (1 hour)

We instructed subjects to arrive with exercise clothes. The exercise program called Shakkiri exercise was demonstrated by its developer in conference room B. First, the effects of Shakkiri exercise were described, which include releasing shoulder stiffness, leading to mental and physical refreshment. Following the instructions, subjects sat on chairs and practiced Shakkiri exercise with music.

4. Psychological test and saliva collection (30 min)

Both groups gathered again in conference room A after program completion.

Centrifuge tubes were handed out to each subject and their saliva was collected. Participants then answered the psychological questionnaire using their unique number, and no name was signed. Collected saliva was stored and delivered in the same way as in pre-intervention.

5. Collecting the questionnaire at 1-month follow-up

The same questionnaires were administered to subjects with a reply envelope to return the papers 1 month post-intervention. We sent a reminder to improve response rates.

6. Ethical considerations

We explained to participants orally and in writing that they would not be personally identified, and that the participation would be of their own free will. Approval was obtained from the Ethical Committee of the Graduate School of Comprehensive Human Sciences, University of Tsukuba.

7. Contents of the psychological questionnaire

- a. Mental Resilience Scale (21 items, 63 points) [13]
- b. Self-Affirmation Scale (10 items, 20 points) [14]
- c. Self-Representation Behavioral Scale (10 items, 20 points) [14]
- d. Problem Solving Behavioral Scale (10 items, 20 points) [15]
- e. Mental Independence Behavioral Scale (10 items, 15 points) [15]
- f. Mental Support from Family Scale (10 items, 10 points) [16]
- g. Mental Support from Others Scale (10 items, 10 points) [17]
- h. Self-Rating Depression Scale (SDS; 20 items, 80 points) [18]
- i. State-Trait Anxiety Inventory (STAI; 20 items, 80 points) [20]
- j. Face sheet items

Age, sex, occupation, counseling experience, and existence of present mental stress.

2.4. Intervention details

1. SAT resilience program

SAT therapy assumes that resilience is increased by belief in one's self-image, representing the self without others' feelings or thoughts, and active problem solving. There is a structured self-image sheet based on the theoretical assumptions of SAT therapy. Participants were guided individually to follow the instructions with the self-image sheet. They created imaginary siblings and children with surrogate facial representatives. They were advised to look at the surrogate facial representatives daily.

2. Shakkiri exercise program

After warming up, participants stretched their bodies with light music while sitting on a chair. Rhythmic motion activates secretion of serotonin, leading to mental stability [22]. For cool down, participants were sprinkled with a scent and they relaxed their body with eyes closed. This program is intended to relax the body and soul. They were advised to practice Shakkiri exercise daily.

2.5. Hypothesized intervention effects

For the SAT resilience program, we hypothesized that intervention effects would show improved anxiety, depression, and increased salivary SIgA at post-intervention. Further, self-image (script) would show improved self-representation, mental independence, self-affirmation, and problem-solving behavior. Depression in particular would decrease over 1 month. On the other hand, effects of Shakkiri exercise would include improved anxiety, depression, and increased salivary SIgA. However, self-image factors are not hypothesized to change. Further, depression would not continue decreasing over 1 month.

2.6. Analysis

SPSS (version 19.0) was used for statistical analysis. Cronbach's alpha was computed to test reliability. Correlations were estimated using Spearman's rank-order correlation to study criterion-related validity based on SDS as the external criterion. Pre-/post-intervention results for psychological measured were measured using the Mann-Whitney U-test. For the 1-month follow-up, we used the Wilcoxon signed-rank test, with Bonferroni correction after the Friedman test.

Table 1. Reliability and validity of each scale

Scale	Reliability		Criterion-related validity b)	
	Cronbach's alpha a)		Depression SDS	
	Pre	Post	Pre	Post
Self-Image	0.85	0.82	0.45	0.48
Problem Solving	0.78	0.75	0.42	0.45
Self-Representation	0.82	0.79	0.48	0.51
Mental Independence	0.80	0.77	0.46	0.49
Self-Affirmation	0.83	0.80	0.47	0.50
Problem-Solving Behavior	0.79	0.76	0.44	0.47
Depression	0.88	0.85	0.52	0.55
Anxiety	0.86	0.83	0.50	0.53
Resilience	0.84	0.81	0.49	0.52

3. Results

3.1. Reliability and validity of scale analysis

Reliability of each scale as measured by Cronbach's alpha is shown as Table 1. Most were over 0.7, except perceived mental support from others post-intervention. Spearman's rank-order correlation measured criterion-related validity with SDS as the criterion variable.

Note: a) Cronbach's alpha b) Criterion-related validity based on SDS as the criterion. Each scale was studied by correlation analysis.

N = 26, *p < .05; **p < .01

3.2. Change in SIgA

In general, changes in SIgA are associated with reduced physical ability and changes in mucosal tissue, as well as a weakened immune system [23]. Willemssen (2002) found that, among 78 males and 79 females, males show greater secretion of SIgA than females do during an active coping task [24] [25]. A large-scale epidemiological study of 2153 adults showed that males secrete more saliva as well as SIgA. However, this decreases with age, and lower socioeconomic status is associated with reduced saliva production [26]. Therefore, we considered potential bias from age and sex in the comparison between the SAT group (age range 34 to 60, 9 females) and the exercise group (age range 32 to 57, 9 females). Both the SAT group and the exercise group showed increased secretion of immunoglobulin SIgA, showing improved immunity (Figs. 1 and 2).

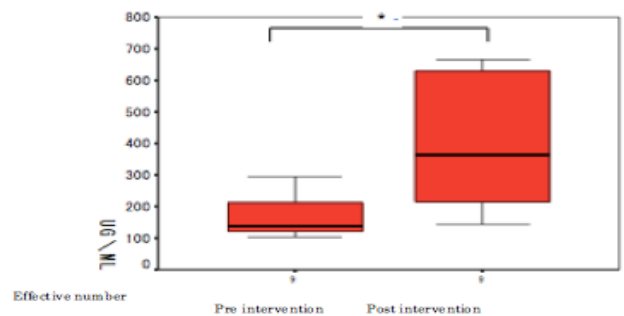


Fig. 1 Changes in SIgA secretion in the SAT group

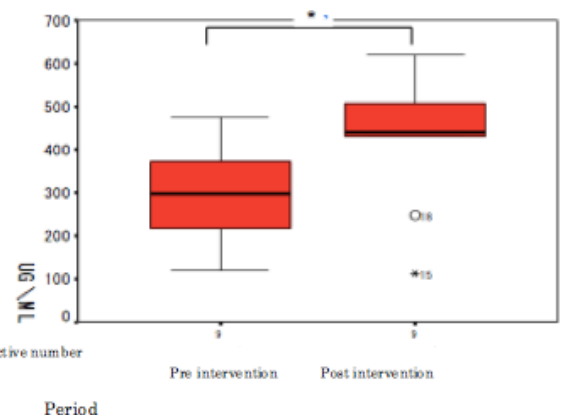


Fig. 2 Changes in SIgA secretion in the exercise group

Wilcoxon signed-rank test (*p = 0.05) N = 9

Pre-intervention – post-intervention (z = -2.429, p = 0.015)

Wilcoxon signed-rank test (*p = 0.05) N = 9

Pre-intervention – post-intervention (z = -1.836, p = 0.012)

3.3. State anxiety and depression

For the SAT group, a significant difference in depression and anxiety was observed between pre- and post-intervention and pre-intervention and the 1-month follow-up (Fig. 3), but there was no such difference between post-intervention and the 1-month follow-up. There were significant differences between pre- and post-intervention and the 1-month follow-up, with sample size of 17 (all SAT program participants).

A significant difference in depression was also observed pre-/post-intervention in the exercise group. However, there was no such difference at the 1-month follow-up, and no trend even at the 10% level. A significant difference in state anxiety was not observed pre-/post-intervention or between pre-intervention and the 1-month follow-up, nor was there a trend at the 10% level (Fig. 4)

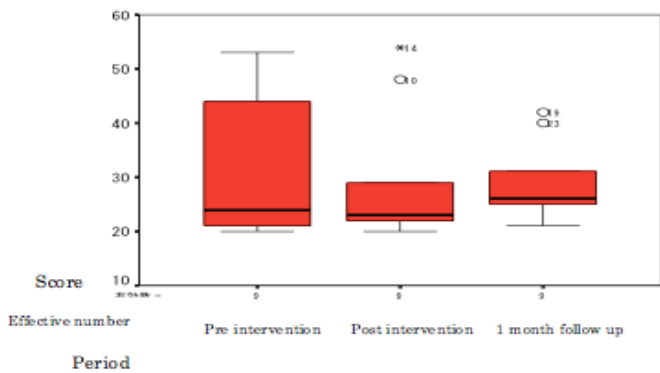


Fig. 3 Changes in anxiety and depression scales at pre- and post-intervention and the 1-month follow-up for the SAT group

Friedman test ($\chi^2 = 16.710, p < 0.001$) N=9

Wilcoxon signed-rank test, pre – post-intervention ($z = -2.677, p = 0.007$); pre-intervention – 1-month follow-up ($z = -2.668, p = 0.008$)

Bonferroni correction * < .025

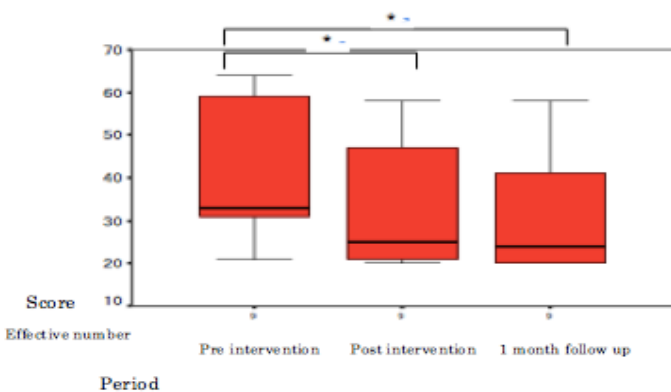


Fig. 4 Changes in state anxiety pre-/post-intervention and the 1-month follow-up in the exercise group

Friedman test ($\chi^2 = 0.800, p = 0.670$) N = 9

3.4. Changes in self-image script

In the SAT group, a significant difference in problem-solving behavior was observed between pre- and post-intervention and pre-intervention and the 1-month follow-up at the 5% level (Fig 5). A significant difference in self-affirmation was observed between pre-intervention and 1-month follow-up (Fig. 6). A trend at the 10% level were observed for mental resilience and self-representation. Significant differences in mental resilience and

self-representation were observed for pre-/post-intervention and the 1-month follow-up at the 5% level.

In the exercise group, a significant difference in mental resilience and depression was observed pre-/post-intervention. At the 1-month follow-up, a significant difference was not observed, nor was there a trend at the 10% level. No significant differences were observed for self-affirmation, self-representation, problem-solving, or mental independence pre-/post-intervention or at the 1-month follow-up, nor was there was trend at the 10% level.

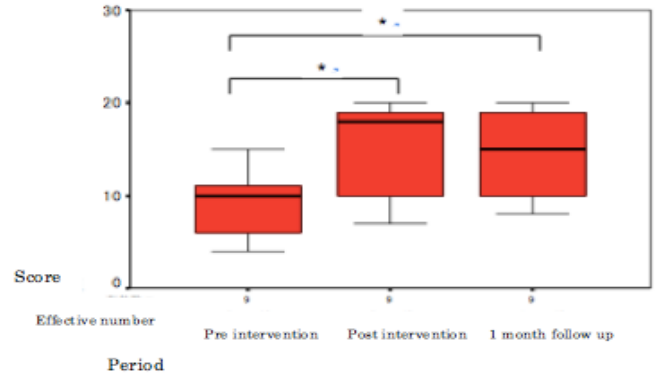


Fig. 5 Problem-solving changes in the SAT group

Friedman test ($\chi^2 = 9.750, p = 0.008$) N = 9

Wilcoxon signed-rank test, pre – post-intervention ($z = -2.492, p = 0.013$); pre-intervention – 1-month follow-up ($z = -2.490, p = 0.013$)

Bonferroni correction * < .025

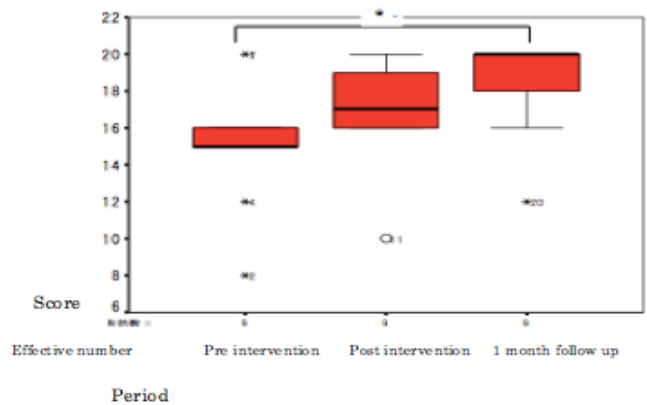


Fig. 6 Changes in self-affirmation for the SAT group

Friedman test ($\chi^2 = 11.655, p = 0.003$) N = 9

Wilcoxon signed-rank test, pre – post-intervention ($z = -1.975, p = 0.048$); pre-intervention – 1-month follow-up ($z = -2.374, p = 0.0176$)

Bonferroni correction * < .025

3.5. Mental support from family

A significant difference in both groups was observed, though this was a trend at the 10% level for the SAT group. A significant difference in mental support from family was observed at pre- and post-intervention and at the 1-month follow-up.

4. Discussion

We comparatively studied the SAT resilience program as the intervention group and an exercise group as the control group. We measured state anxiety, depression, and secretion of

immunoglobulin in saliva (SIgA) at pre- and post-intervention. In the SAT group, a significant difference was observed in state anxiety, depression, and SIgA.

In the exercise group a significant difference was observed in depression and SIgA, excluding state anxiety. This result was similar to previous findings on cancer patients. One type of SAT imagery therapy, three-generation therapy (participants image their mother's womb and go back three generations, and then change their brief self-image by changing the image of crisis in the womb), developed in 2009, was carried out on cancer patients in the form of both group intervention and DVD intervention [27]. It showed that state anxiety and depression decreased significantly and SIgA increased significantly. It has also been reported that exercise increases SIgA secretion [28].

In this study, which used SAT imagery therapy, mental health and an immunity indicator (SIgA) improved between pre- and post-intervention. Changing the self-image can occur between pre- and post-intervention, a change particularly evident in problem-solving behavior. The intervention group had memories that their parent contacted their true self in terms of strictness, expression, and sadness. Therefore, they did not experience the feeling of being protected by the parent, and they had feelings of fear, anxiety, panic, self-hatred, and a sense of helplessness with regard to their true self. They even felt hopeless for the future. With daily observance of the surrogate facial representations of wished family, it is expected they would not feel fear, anxiety, self-hatred, panic, or helplessness.

Once the subjects engaged daily with the facial representation of wished family (SKP), their expectations of family decreased, and their family image improved. This has been shown in actual SKP therapy. It is thought that improving the family image, including parents and facial images of wished family (SKP), decreases feelings of fear, anxiety, and self-hatred, as well as improving self-image. Some benefits of this view of the self-image include, "it is less likely to get emotional," "able to judge while confirming each fact," and "try to make a forecast and plan before new initiatives." This facilitates the ability to forecast to solve the problem independently, helping to improve state anxiety and depression as well as immunity. A significant difference was observed in self-image, state anxiety, and self-affirmation in the SAT group from pre-intervention to 1-month. To compare with the exercise group, the SAT sample was reduced to 9. There was no difference at the 5% level, but there was a trend at the 10% level. For the entire SAT group (17 participants), there was a significant difference in self-affirmation, self-representation, and problem-solving, but not mental independence between pre-intervention and 1-month follow-up. State anxiety, depression, and mental resilience also significantly improved. The SAT resilience program improved mental health not only in the short term, but also 1 month later. Resilience developed into the strength to recover from stress, fight against stress, and improve. The self-image script of self-affirmation, self-representation, problem-solving, and mental resilience remained. State anxiety and depression seemed to be prevented. However, there was not an appropriate control group for the 17 participants. Thus, the implications remain unclear. Previous research on nurses did not find a significant difference in the non-intervention group for a short-term intervention.

In a group intervention that applied SKP imagery therapy, characteristic anxiety decreased after 6 months. This was apparently caused by improvement of the self-image script, www.astesj.com

reflecting self-value and characteristic behavior including problem-solving, self-repression, and emotion recognition [29]. Only self-affirmation changed significantly in a comparison of the assertion training group; however, in SKP imagery therapy, all self-image script factors—self-value and characteristic behavior including depression and problem-solving—changed significantly [30]. Given these considerations, the findings should extend to the general population. Further research with larger control groups is required. This appears to be a sustainable effect, however, as a short-term intervention of company management improved characteristic behaviors including self-repression, anxiety, and depression up to a 6-month follow-up [31].

This study was an intervention study of resilience among the general population on their resistance to daily stresses. Because of the earthquake in eastern Japan, some of the participants might have been under unusual stresses. Regarding this situation, we should consider individual intervention. Several issues remain for future study. Sample size should be increased for both groups. Further, the SAT therapy should be extended beyond the simple SAT method to the clinical three-generation therapy method, even for the short term. Therefore, to apply three-generation therapy, development is required to be appropriate for group work and sustainable effects. We will consider developing the short program as well as a 3-day training program moving forward.

References

- [1] Ministry of Health, Labour and Welfare: A minister's secretariat Statistical Information Department society statistics section life of the people basics investigation room, <http://www.mhlw.go.jp/toukei/saikin/hw/k-tyosa/k-tyosa10/>, 12/12, 2011
- [2] National Police Agency: Life security station, Life security planning division, <http://www.npa.go.jp/safetylife/seianki/H22jisatsunogaiyou.pdf>, 12/12, 2011
- [3] Rutter, M: Resilience in the face of adversity, protective factors and resistance to psychiatric disorder. *Br J Psychiatry* 147: 598-611, 1985
- [4] Herman, J L: Trauma and recovery, Misuzu Publishing, Tokyo, 283-294, 1999
- [5] Hoge, E A, Austin, E D, Pollack, M H: Resilience: research evidence and conceptual considerations for posttraumatic stress disorder. *Depress Anxiety*, 24(2), 139-152, 2007
- [6] Bonanno, G A: Loss, trauma, and human resilience: have we underestimated the human capacity to thrive after extremely aversive events? *Am Psychol*, 59(1), 20-28, 2004
- [7] Naoi, K: Analysis of local mental health activity earthquake disaster three and a half months after the Niigata Chuetsu Earthquake and 13 months later: findings and the PTSD risk factor, *Jpn Soc Psychiatry Mag*, 67(4), 486, 2009
- [8] Munakata, T: Structured Association Technique Therapy, Kaneko Bookshop, Tokyo, 35-32, 2006
- [9] Masten, A S and Coatsworth, J D: The development of competence in favorable and unfavorable environments-lessons from research on successful children, *Am Psychol*, 53, 205-220, 1998
- [10] D'Zurilla, T J and Nezu, A M: Development and preliminary evaluation of the Social Problem-Solving Inventory, *Psychol Assess*, 2, 159-163, 1990
- [11] Werner, E E: Protective factors and individual resilience. *Handbook of Early Childhood Intervention*. Ed. By Meisel S J and Shonkoff, J P, Cambridge University Press, Cambridge, 97-116, 1990
- [12] Wagnild, G M and Young, H M: Development and psychometric evaluation of the Resilience Scale, *J Nurs Meas*, 1, 165-178, 1993
- [13] Oshio, A et al.: Construct validity of the Adolescent Resilience Scale. *Psychol Rep*, 93, 1217-1222, 2003
- [14] Munakata, T: Measure the unsolved feelings that became the scientific potentiality of remembrance, transmission, the conversion of the heart, *Health Couns*, 3(6), 94-102, 2001

- [15] Munakata, T: Recognition and coping action of the stress source, *Mental Health Study*, National Mind Nerve Center, 39, 29-40, 1993
- [16] Kazuhiro, Y and Munakata, T: Development of the mental health-related standard for Japanese, *Soc Mental Health*, 3, 63-67, 1997
- [17] Munakata, T et al.: Stress and mind health degree of the city citizen, 32, 49-68, 1986
- [18] Zung, W W K: A Self-Rating Depression Scale. *Arch Gen Psychiatry*, 12, 63-70, 1973
- [19] Fukuda, K and Kobayashi, S: Japanese edition SDS use guide, 30 Quadrillion Bunches, Kyoto, 1970
- [20] Spielberger, C D et al: STAI manual, Palo Alto, CA, Consulting Psychologist Press, 1970
- [21] Hidano, T et al.: New publication STAI manual, Business Education Publication, Tokyo, 1-10, 2000
- [22] Arita, H: Where rhythm movement lets serotonin nervous system activate from basic medicine, *Japanese Medical Affairs Courier*, 4453, 38-42, 2009
- [23] Sawada, et al.: Change of the secretion type immunoglobulin A out of saliva in the everyday life of the long-term medical treatment elderly person, *Sports Sci*, 57, 241-248, 2008
- [24] Willemsen, G, et al.: Cellular and mucosal immune reactions to mental and cold stress: associations with gender and cardiovascular reactivity, *Psychophysiol*, 39, 222-228, 2002
- [25] Fujiwara, S and Yogo, M: Stress and affective psychology organon with s-IgA as an index, *Doshisha Psychol*, 50, 57-81, 2003
- [26] Evans, P et al.: Social class, sex, and age difference in mucosal immunity in a large community sample, *Brain, Behav Immun*, 14, 41-48, 2000
- [27] Higuchi, N et al.: Comparative examination of the effects of the SAT-DVD learning program therapy and the Qigong (the traditional Chinese breathing exercise) therapy to alleviate stress in cancer survivors, *Int J Struct Assoc Technique*, 3, 61-90, 2009
- [28] Akama, T et al.: Change of salivary secretory IgA by 42 months exercise training in elderly persons, *Sports Health Sci*, 2, 122-127, 2005
- [29] Taniguchi, S: Group intervention support about mental health and resilience of the nurse, *J Health Counsel*, 18, 19-26, 2012
- [30] Taniguchi, S: Middle effect of the mental health by the self-image rebuilding using the image method to a nurse, *Jpn Health Med Care Behav Sci Soc Mag*, 28(1), 71-81, 2013
- [31] Yamamoto, M and Munakata, T: Examination of self-image and -9 self-reward type carrier training back issue intervention effects of the company manager, *Sociol Mental Health*, 17, 31-38, 2011

A Clinical Review of Zika Virus (ZIKAV)

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ARTICLE INFO

Article history:

Received: 08 December, 2017

Accepted: 12 February 2017

Online: 25 February, 2017

Keywords:

ZIKAV

ZIKA Virus

ZIKV

Review of ZIKA Virus

ABSTRACT

Zika virus (ZIKAV) is a flavi-virus, first isolated in 1947 in the Zika Forest of Uganda. ZIKAV is a positive-sense single-stranded RNA virus. ZIKAV is made up of two noncoding regions (5' and 3') that verge an open reading frame, which put into code a polyprotein smote into the capsid, precursor of membrane, envelope, and 7 nonstructural proteins. Inoculation of a human host is by Mosquito. After cellular entry, the virus enters skin cells through cellular receptors, enabling migration to the lymph nodes and blood circulation. ZIKAV may also enter to skin fibroblasts, keratinocytes, and immature dendritic cells. Several entry and adhesion factors enable infection, and cellular autophagy, needed for flaviviral replication. Transmission is by infected mosquito during a blood meal. After endorsement, the virus replicates and is pass on to a reservoir animal at the next blood mealtime. ZIKAV is also transmitted via congenital, perinatal, and sexual, possible transmission by blood transfusion, animal bite and intrauterine transmission. Transmission via breast-feeding has not been reported. Incubation period from mosquito bite to symptom commencement is 3–12 days. Infection is likely subclinical in 80% of cases. Symptoms, which last for almost two to seven days include fever, conjunctivitis, arthralgia, myalgia, and pervasive rash, which may be itchy. Headache, retro-orbital pain, peripheral oedema, and gastrointestinal fracas have also been witnessed. Diagnosis is directed by history and consideration. The symptoms and clinical signs do not have adequate positive or negative prognostic value, and therefore laboratory testing is needed for dependable diagnosis. Laboratory testing includes polymerase chain reaction (PCR) of ZIKAV RNA. There is formerly no vaccine against ZIKAV, nor definite antiviral for the management of ZIKAV. Treatment is suggestive. Vector control by insecticides and removal of small pools of still water, the breeding sites for Aedes, is being instituted on a local level.

1. Introduction

Zika virus is a flavivirus and it was first isolated in 1947 from a febrile rhesus macaque monkey in the Zika Forest of Uganda. Subsequently it was identified in Aedes africanus mosquitoes from the same forest [1]. In 1954 the first three cases of human infection were reported in Nigeria [2] and epidemics have

occurred in French Polynesia Cook Islands [3], Easter Island [4], New Caledonia [5] and latest the Americas. [6]

2. Search Policy/Selection Criteria

We used the keywords Zika, ZIKV, ZIKAV, and Zika virus in search bar of Google and PubMed. We look over all literature published through November 30, 2016. The search comprised English and other foreign language articles, which were computer decoded.

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<https://dx.doi.org/10.25046/aj020202>

3. Virology and Pathogenesis

Zika virus (ZIKAV) is a positive-sense single-stranded RNA virus in the family Flaviviridae which includes several other mosquito-borne viruses of clinical status (e.g., DENV, WNV, and yellow fever virus [YFV]) [7]. Like other flaviviruses, ZIKAV is made up of two noncoding regions (5' and 3') that verge an open reading frame, which put into code a polyprotein smote into the capsid, precursor of membrane, envelope, and 7 nonstructural proteins [8]. A study ZIKAV's molecular evolution, based on viral strains collected from 4 countries in West Africa during 1947–2007, identified several sites within the Zika viral genome that were under strong negative miscellany pressure. This finding proposes frequent purging of deleterious polymorphisms in functionally essential genes and the likelihood of recombination, which occurs rarely among flaviviruses [9]. After mosquito inoculation of a human host, cellular entry likely look like that of other flaviviruses, whereby the virus enters skin cells through cellular receptors, enabling migration to the lymph nodes and blood circulation. Few studies have investigated the pathogenesis of ZIKAV infection. One study showed that human skin fibroblasts, keratinocytes, and immature dendritic cells allow entry of ZIKAV. Several entry and adhesion factors (e.g., AXL receptor tyrosine kinase) enable infection, and cellular autophagy, needed for flaviviral replication, develops ZIKAV replication in skin fibroblasts [10]. After cellular entry, flaviviruses typically replicate within endoplasmic reticulum-derived vesicles. However, ZIKAV antigens were found exclusively in the nuclei of infected cells; this finding suggests a location for replication that differs from that of other flaviviruses and merits further exploration [11].

4. Transmission

Zika virus, like other flaviviruses, is pass on by mosquito-toes, primarily of the *Aedes* (*Stegomyia*) genus. The *Ae. aegypti* mosquito acts to be the major vector in Asia [12]. Zika virus has been detected in wild-caught *Ae. aegypti* mosquitoes, which laboratory trials have shown to be capable of pass on Zika virus [13,14]. *Aedes* mosquitoes are widely distributed worldwide, and natural habitats of most species are warm tropical and sub-tropical regions [15-17]. Mosquito getting hold of the virus likely occurs during a blood meal; after endorsement, the virus replicates and is pass on to a reservoir animal at the next blood mealtime [18]. Isolation of the virus or of anti-Zika virus antibodies from various non-human primates and other wild and native animals suggests several animal reservoirs. Other nonvector modes of Zika virus transmission include congenital, perinatal [19], and sexual [20]. Possible transmission by blood transfusion [21,22], animal bite [23]. Intrauterine transmission is supported by the finding of Zika virus RNA by reverse transcription PCR (RT-PCR) in amniotic fluid of 2 mothers with symptoms of Zika virus infection during pregnancy; both delivered babies with microcephaly [24]. Viral RNA, but not culturable virus, has been detected in breast milk [25], but transmission by breast-feeding has not been reported.

Two cases of possible transfusion-transmitted (TT) Zika virus were reported in Brazil [21]. Furthermore, during the French Polynesia outbreak, a study found that 42 (2.8%) of 1,505 subclinical blood donors were positive for Zika virus by RT-PCR; 11 donors pronounced a Zika fever-like syndrome 3–10 days after donation [20].

5. Clinical Manifestations

In humans, the incubation period from mosquito bite to symptom commencement is 3–12 days. Infection is likely subclinical in 80% of cases [23,24]. Zika virus infections seem either to be subclinical (possibly in as many as 80% of infections) or to cause a trifling illness after an incubation period of 3 to 12 days. Symptoms, which last for almost two to seven days include fever, conjunctivitis, arthralgia, myalgia, and pervasive rash, which may be itchy. Headache, retro-orbital pain, peripheral oedema, and gastrointestinal fracas have also been witnessed. Only one study has examined the proportion of infections that produce symptoms. A serological survey during the Yap outbreak found that only 19% of partakers with IgM antibodies against Zika virus stated rash, joint pains, or conjunctivitis that were probably attributable to Zika virus infection. Whether the remaining infected participants experienced any other symptoms was not reported [23]. Observation of Zika viraemia in 31 French Polynesian blood donors who reported no symptoms, during or after blood donation, suggests that asymptomatic infection does occur [20]. Shock and hemorrhage occur with other flaviviruses such as dengue, but they have not been documented in Zika virus infection. Severe acute illness seems to be rare. Fewer than 10 possible Zika related deaths have been reported in adults, and an additional three deaths from Guillain-Barré syndrome have arisen in those who had symptoms of Zika infection [27,28].

6. Diagnosis

The clinical picture of Zika virus infection is alike to that of former mosquito-borne viruses such as dengue and chikungunya. Which often co-mingle in the zones, where Zika virus is endemic. The differential diagnosis of Zika virus infection is wide. Diagnosis is directed by history (travel, sexual behaviors, and interaction with other causes of infection) and consideration. Additionally to dengue and chikungunya, other diagnoses that should be considered include HIV seroconversion, measles, scarlet fever, rickettsial infection, leptospirosis, parvovirus, enterovirus, rubella, and secondary syphilis. The symptoms and clinical signs do not have adequate positive or negative prognostic value, and therefore laboratory testing is needed for dependable diagnosis.

6.1 Laboratory Testing

Conclusive diagnosis is based on recognition of Zika virus RNA in blood (serum or, ideally, EDTA treated plasma) and other body fluids by polymerase chain reaction (PCR). Subsequently to the acute phase, diagnosis by antibody detection in serum samples is conceded by substantial cross reactivity with antibodies to other flaviviruses; false positive results can be comprehended with past

dengue infection or previous yellow fever vaccination [29]. Details are shown in Table:

Sample	Test	Timing
Blood	Polymerase chain reaction	Usually <5 days (occasionally up to 8 days) from symptom onset. [28]
Serum	IgM antibody detection	Measurable 4-7 days from symptom beginning and continues for 2-12 weeks. [29]
Saliva	Polymerase chain reaction	Usually <5 days (seldom up to 8 days) from symptom commencement. [28]
Semen	Polymerase chain reaction	Very limited data: RNA has been spotted at 62 days after symptom onset in one case. [30]
Urine	Polymerase chain reaction	Very limited data: single study (6 patients)—positive in 6/6 at 10 days from symptom commencement, and 1/6 quiet positive at 30 days. [31]

7. Management and Prevention

There is formerly no vaccine against Zika virus, nor definite antiviral for the management of Zika virus. Treatment is suggestive, although it is not known what agents are prime for treating the fever, itch, and arthralgia. Minimization of the gamble of mosquito bites is advised by taxing long sleeves and khakis and using mosquito repellents [34].

Vector control by insecticides and removal of small pools of still water, the breeding sites for *Aedes*, is being instituted on a local level. Trials of the release of treated sterile mosquitoes are being deliberated by WHO.

Recommendation

- Promote awareness campaign for prevention of Zika virus in public by eradication of Mosquito habitat.
- Development of vaccine for the treatment of Zika virus.

Conflict of Interest

The authors declare no conflict of interest.

Acknowledgment

Special thanks to Dr. Jabar Zaman Khan Khattak for appreciation and guidance.

References

- Dick GW, Kitchen SF, Haddow AJ. Zika virus. I. Isolations and serological specificity. *Trans R Soc Trop Med Hyg.* 1952;46:509–20. [http://dx.doi.org/10.1016/0035-9203\(52\)90042-4](http://dx.doi.org/10.1016/0035-9203(52)90042-4)
- MacNamara FN. Zika virus: a report on three cases of human infection during an epidemic of jaundice in Nigeria. *Trans R Soc Trop Med Hyg.* 1954;48:139–45. [http://dx.doi.org/10.1016/0035-9203\(54\)90006-1](http://dx.doi.org/10.1016/0035-9203(54)90006-1)
- Roth A, Mercier A, Lepers C, Hoy D, Duituturaga S, Benyon E, et al. Concurrent outbreaks of dengue, chikungunya and Zika virus infections - an unprecedented epidemic wave of mosquito-borne viruses in the Pacific 2012–2014. *Euro Surveill.* 2014;19:20929.
- Tognarelli J, Ulloa S, Villagra E, Lagos J, Aguayo C, Fasce R, et al. A report on the outbreak of Zika virus on Easter Island, South Pacific, 2014. *Arch Virol.* 2016;161:665–8. <http://dx.doi.org/10.1007/s00705-015-2695-5>
- Dupont-Rouzeyrol M, O'Connor O, Calvez E, Daurès M, John M, Grangeon JP, et al. Co-infection with Zika and dengue viruses in 2 patients, New Caledonia, 2014. *Emerg Infect Dis.* 2015;21:381–2. <http://dx.doi.org/10.3201/eid2102.141553>
- Fauci AS, Morens DM. Zika virus in the Americas—yet another arbovirus threat. *N Engl J Med.* 2016;374:601–4. <http://dx.doi.org/10.1056/NEJMp1600297>
- Lanciotti RS, Kosoy OL, Laven JJ, Velez JO, Lambert AJ, Johnson AJ, et al. Genetic and serologic properties of Zika virus associated with an epidemic, Yap State, Micronesia, 2007. *Emerg Infect Dis.* 2008;14:1232–9. <http://dx.doi.org/10.3201/eid1408.080287>
- Kuno G, Chang GJ. Full-length sequencing and genomic characterization of Bagaza, Kedougou, and Zika viruses. *Arch Virol.* 2007;152:687–96. <http://dx.doi.org/10.1007/s00705-006-0903-z>
- Faye O, Freire CC, Iamarino A, Faye O, de Oliveira JV, Diallo M, et al. Molecular evolution of Zika virus during its emergence in the 20(th) century. *PLoS Negl Trop Dis.* 2014;8:e2636. <http://dx.doi.org/10.1371/journal.pntd.0002636>
- Hamel R, Dejarnac O, Wichit S, Ekchariyawat P, Neyret A, Luplertlop N, et al. Biology of Zika virus infection in human skin cells. *J Virol.* 2015;89:8880–96. <http://dx.doi.org/10.1128/JVI.00354-15>
- Buckley A, Gould EA. Detection of virus-specific antigen in the nuclei or nucleoli of cells infected with Zika or Langkat virus. *J Gen Virol.* 1988;69:1913–20. <http://dx.doi.org/10.1099/0022-1317-69-8-1913>
- Olson JG, Ksiazek TG, Suhandiman, Triwibowo. Zika virus, a cause of fever in Central Java, Indonesia. *Trans R Soc Trop Med Hyg.* 1981;75:389–93. [http://dx.doi.org/10.1016/0035-9203\(81\)90100-0](http://dx.doi.org/10.1016/0035-9203(81)90100-0)
- Diallo D, Sall AA, Diagne CT, Faye O, Faye O, Ba Y, et al. Zika virus emergence in mosquitoes in southeastern Senegal, 2011. *PLoS One.* 2014;9:e109442. <http://dx.doi.org/10.1371/journal.pone.0109442>
- Boorman JP, Porterfield JS. A simple technique for infection of mosquitoes with viruses; transmission of Zika virus. *Trans R Soc Trop Med Hyg.* 1956;50:238–42. [http://dx.doi.org/10.1016/0035-9203\(56\)90029-3](http://dx.doi.org/10.1016/0035-9203(56)90029-3)
- Ledermann JP, Guillaumot L, Yug L, Saweyog SC, Tided M, Machieng P, et al. *Aedes hensilli* as a potential vector of Chikungunya and Zika viruses. *PLoS Negl Trop Dis.* 2014;8:e3188. <http://dx.doi.org/10.1371/journal.pntd.0003188>
- Kraemer MU, Sinka ME, Duda KA, Mylne A, Shearer FM, Brady OJ, et al. The global compendium of *Aedes aegypti* and *Ae. albopictus* occurrence. *Sci Data.* 2015;2:150035. <http://dx.doi.org/10.1038/sdata.2015.35>
- Gaffigan TVWR, Pecor JE, Stoffer JA, Anderson T. Systematic catalog of culicidae. Suitland (MD): Smithsonian Institution; Silver Spring (MD): Walter Reed Army Institute of Research; 2016 [cited 2016 Feb 10]. <http://mosquitocatalog.org/>
- Haddow AD, Schuh AJ, Yasuda CY, Kasper MR, Heang V, Huy R, et al. Genetic characterization of Zika virus strains: geographic expansion of the Asian lineage. *PLoS Negl Trop Dis.*
- Musso D, Roche C, Robin E, Nhan T, Teissier A, Cao-Lormeau VM. Potential sexual transmission of Zika virus. *Emerg Infect Dis.* 2015;21:359–61. <http://dx.doi.org/10.3201/eid2102.141363>
- Musso D, Nhan T, Robin E, Roche C, Bierlaire D, Zisou K, et al. Potential for Zika virus transmission through blood transfusion demonstrated during an outbreak in French Polynesia, November 2013 to February 2014. *Euro Surveill.* 2014;19:20761. <http://dx.doi.org/10.2807/1560-7917.ES2014.19.14.20761>
- US Food and Drug Administration. Recommendations for donor screening, deferral, and product management to reduce the risk of transfusion transmission of Zika virus, recommendations for industry. 2016 Feb 16 [cited 2016 Feb 16].

<http://www.fda.gov/downloads/BiologicsBloodVaccines/GuidanceComplianceRegulatoryInformation/Guidances/Blood/UCM486360.pdf>

- [22] Leung GH, Baird RW, Druce J, Anstey NM. Zika virus infection in Australia following a monkey bite in Indonesia. *Southeast Asian J Trop Med Public Health*. 2015;46:460–4.
- [23] Duffy MR, Chen TH, Hancock WT, Powers AM, Kool JL, Lanciotti RS, et al. Zika virus outbreak on Yap Island, Federated States of Micronesia. *N Engl J Med*. 2009;360:2536–43.
- [24] Ios S, Mallet HP, Leparc Goffart I, Gauthier V, Cardoso T, Herida M. Current Zika virus epidemiology and recent epidemics. *Med Mal Infect*. 2014;44:302–7. <http://dx.doi.org/10.1016/j.medmal.2014.04.008>
- [25] Oliveira Melo AS, Malinger G, Ximenes R, Szejnfeld PO, Alves Sampaio S, Bispo de Filippis AM. Zika virus intrauterine infection causes fetal brain abnormality and microcephaly: tip of the iceberg? *Ultrasound Obstet Gynecol*. 2016;47:6–7.
- [26] Besnard M, Lastere S, Teissier A, Cao-Lorreau V, Musso D. Evidence of perinatal transmission of Zika virus, French Polynesia, December 2013 and February 2014. *Euro Surveill*. 2014;19:20751
- [27] World Health Organization. Zika virus: news and updates. Accessed 19 February 2016. www.who.int/emergencies/zika-virus/timeline-update/en/.
- [28] Pan American Health Organization. Epidemiological alert: neurological syndrome, congenital malformations, and Zika virus infection. Implications for public health in the Americas. 1 December 2015. www.paho.org/hq/index.php?option=com_docman&task=doc_view&Itemid=270&gid=32405&lang=en.
- [29] Charrel RN, Leparc-Goffart I, Pas S, de Lamballerie X, Koopmans M, Reusken C. State of knowledge on Zika virus for an adequate laboratory response. *Bull World Health Organ* 2016; doi:10.2471/BLT.16.171207.
- [30] Musso D, Roche C, Nhan TX, Robin E, Teissier A, Cao-Lorreau VM. Detection of Zika virus in saliva. *J Clin Virol* 2015;68:53-5. doi:10.1016/j.jcv.2015.04.021. 26071336.
- [31] Centres for Disease Control. Revised diagnostic testing for Zika, chikungunya, and dengue viruses in US Public Health Laboratories. Released 7 February 2016. Accessed 12 February 2016. www.cdc.gov/zika/pdfs/denvchikvzikk-testing-algorithm.pdf
- [32] Atkinson B, Hearn P, Afrough B, et al. Detection of Zika virus in semen[letter]. *Emerg Infect Dis* 2016. Accessed 20 February 2016. doi:10.3201/eid2205.160107
- [33] Gourinat AC, O'Connor O, Calvez E, Goarant C, Dupont-Rouzeyrol M. Detection of Zika virus in urine. *Emerg Infect Dis* 2015;21:84-6. doi:10.3201/eid2101.140894. 25530324.
- [34] Stanczyk NM, Behrens RH, Chen-Hussey V, Stewart SA, Logan JG. Mosquito repellents for travellers. *BMJ* 2015;350:h99. doi:10.1136/bmj.h99. 25698775.

Implementation Of Carlson Survey Software 2009 In Survey Works And Comparison With CDS Software

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ARTICLE INFO

Article history:

Received: 15 January, 2017

Accepted: 12 February, 2017

Online: 25 February, 2017

Keywords:

Survey Automation

Cds Civil Design Software

Carlson Survey Software

*Data Processing And Collection
Methods*

ABSTRACT

The automation surveying is one of the most influential changes to surveying concept and profession has had to go through, this has taken effect in two major courses, hardware (instrumentation used in data collection and presentation), and the software (the applications used in data processing and manipulation). Automation is majorly computer based and just like all such systems is subject to improvement often; this is manifested in the new kinds of instrumentation models every few years such as total station and newer versions of software's. The software that has the potential to completely affect survey automation is Carlson Surveying Software. This when coupled with total station as data processing and collection methods respectively; is capable of greatly improving productivity while reducing time and cost required in the long run. However, it is only natural for users to desire a competent software and be able to choose from what is available on the market based on guided research and credible information from previous researches. Such studies not only help in choice of software but are also handy when it comes to testing approaches and recommending improvements based on advantages and disadvantages to the manufacturers to help in advancement in the software industry for better and more comfortable use. The expected outcome of the research is a successful implementation of Carlson survey 2009 software in survey works and a comparison with other existing software like Civil Design Software (CDS) was highlighted its advantages and disadvantages.

1. Introduction

Enwinding surveys establish points by travers baseline or other methods to obtain information required for engineering designs and to set out construction from design drawing by use of these control points. The nature of the data required to be collected, the techniques, instrumentation to be used and the use allocated to the data collected all have a role they play in determining the nature and type of surveying to be carried out. With the new age of computer, there have been drastic and yet amazing changes in profession as pertaining instrumentation and computation and data processing. Total station have replaced plan tables and software has replaced the unwieldy mathematical computations that were previously done through analogue methods. In fact the practice of surveying and mapping has

changed very greatly with the automation nowadays and this has given an all new view to surveying as a discipline. Investments in the surveying field by major commercial interests such as big companies (e.g. LICECA, TOPCON, TRIMBLE and SOKIA) seek to improve their knowledge in these fields such as Global Navigation Satellite Systems (GNSS), Geographic Information System (GIS). The total station is one such advancement in instrumentation that is currently top notch because it contains software components coupled with both an electronic theodolite and distomat, the instrument is very handy in surveys today and is preferred by many surveyors. A difference among all popular survey software on market today like Civil Design Software (CDS), surveying and engineering LISCAD software, Pythagoras, Microsurvey, are: the vary cost to graphic capability function and user friendliness as well as their respective ability to handle large data and heavy projects. Carlson survey 2009

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www.astesj.com

<https://dx.doi.org/10.25046/aj020203>

software is one of the newly developed software made by Carlson Software Inc from united states. This software consists of program integrated with AutoCAD into one package . The capacity of the software has been improved to meet the requirements of a task and fulfill the satisfaction of the user. The software was designed in a complete package that an output needs not to export to another application to produced final results.

A complete survey automation system is basically a combination between the total station and survey software in order to process survey data up to the production of final results in form of maps graph in their softcopy and or hardcopy .where there are many applications software's on the market today that help in engineering survey works it's important to implementation and assess each software carefully to fully understand its operations, advantages and disadvantages . This paper aims to carry out the implementation of Carlson survey software for engineering survey works and compare it to CDS software.

In this research covers a case study in which the sample data by total station from a special selected site in the vicinity of University Technology Malaysia using Carlson surveying 2009 software for processing and manipulation of data. For this study comparison between CDS software and Carlson survey software and demonstrate how suitable each is when used complementarity to total station equipment .also this software is a pivot of further assessment into the approaches of adopting and implementation of Carlson survey software in Libya based engineering survey work with hope of improving the survey methodology in Libya from basic to more advanced automation methods.

2. Data Acquisition:

Data be used for the research project was acquired using a LICA TPS307 series instrument with control being obtained from GPS observation. This instrument is a high quality electronic total station designed for the engineering and construction site surveying. The GPS observation were carried out prior to the topographic survey using a Trimble 4800 receiver for a very short baseline of two point UTM01 and station 2 STN2 which were to be used as control and orientation later in the process of traversing and detailing . The data from the GPS observation was downloaded and processed in Trimble total control software. the GPS benchmark (UTM 01) that was using to establish coordinates of another point for orientation . An area of the whole place was to be about 800m² having a total perimeter of about 400m. For data collection it would be necessary for at least one total station (LICA TPS307, the trigger button functionality and endless motion screws as well as many tripods to enable us to set up many simultaneous targets, as well as 3 or 4 reflector prism ranging . For determination the coordinate of point we use from GPS needed 3 station , first the total station was put on known position point (UTM01) then entered the coordinate

of UTM01 as the station point in total station. second was interring the coordinate of second point as back sight point. Then set the horizontal angle zero in the back-sight direction. For gathering coordinate of required points commence to producing detailed plan should gather the coordinate of every detail in this site. Although gathering the detail depended on the scale of the plan. The sit contained building, tree, float way, street, tower and gathered the coordinate of all of them. Also for creating the counter coordinate gathered of topographies. After that because the other required points were at the back of the building there was need to change the position of the total station on the second station and continued the observation from there. In this station was got other corner of the building float way and terrain. The last station was station three in which gathered the coordinate of one big tree, tower and terrain.

3. Results and Analysis

The results are presented in two forms; those obtained from CDS data processing and those obtained using Carlson survey 2009 software. The detailed plans are DTM in both cases are drawn based on the same study area but processed separately in the two different software. The results as obtained from the methodology followed in this research include detailed plans, DTMs in the form of contours, TIN and GRID. The detailed plan as showed in the Figure 1 represent the area of study (observatory area – University Technology Malaysia). The initial CDS results, after being exported to AutoCAD for editing and improvement to be carried out on the detailed plan is presented as in Figure 2. The 3D presentation of TIN models in CDS software is also represented in Figure 3, which attempts to create a better height and visual interpretation of the topography for users of CDS software.

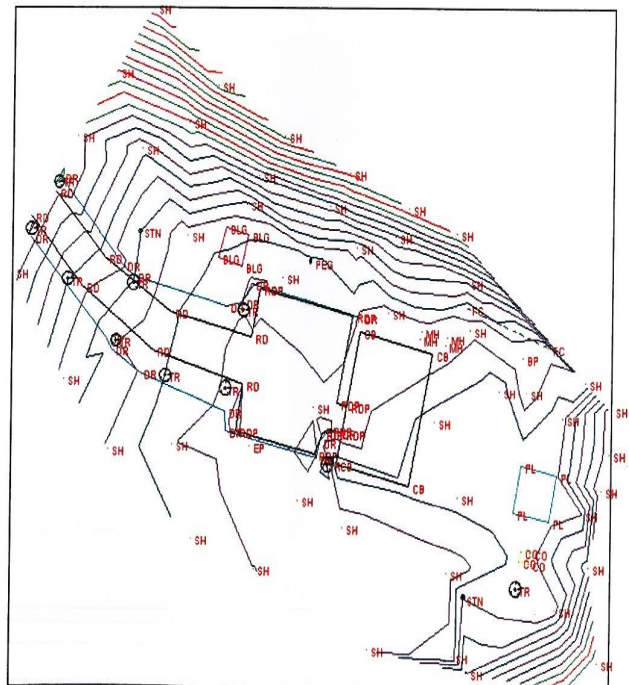


Figure 1 Detail plan from Civil Design Survey Software automation.

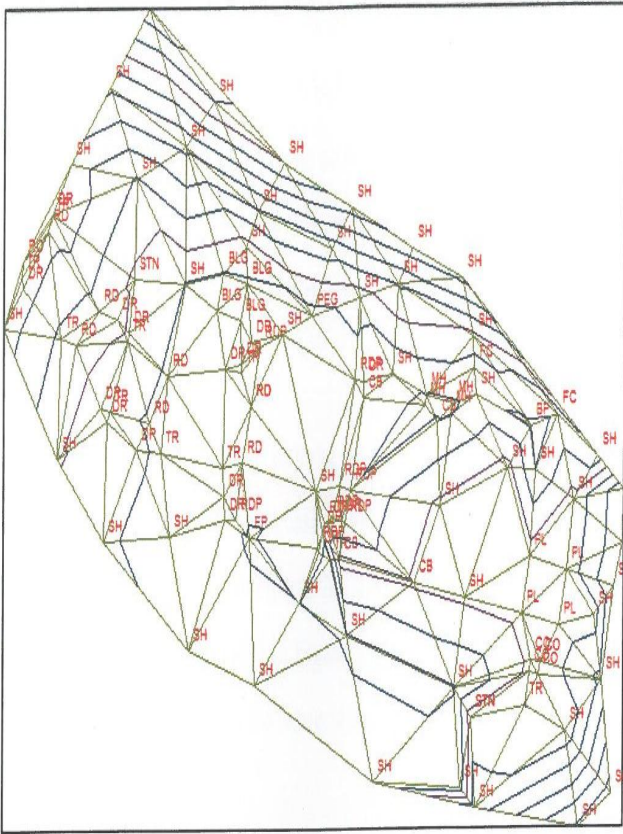


Figure 2 TIN Results from Civil Design Survey Software automation

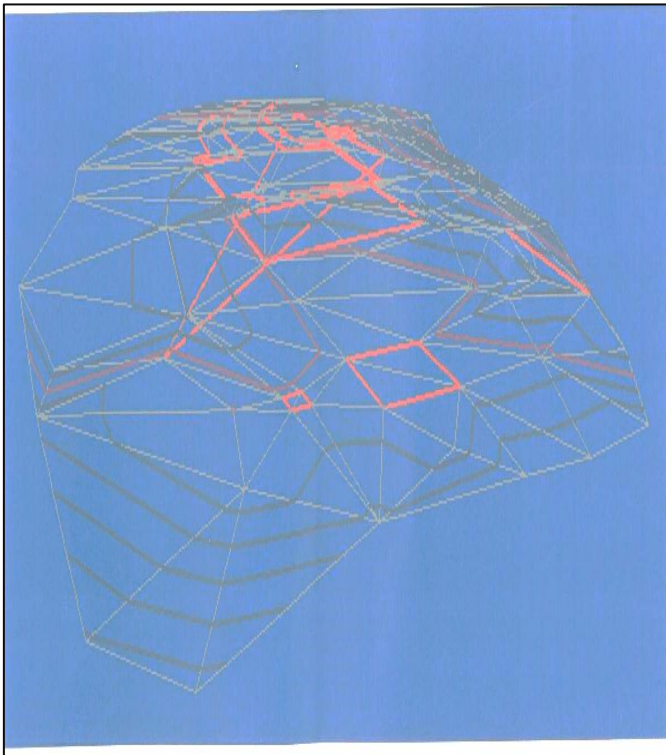


Figure. 3 3D from Civil Design Survey Software automation

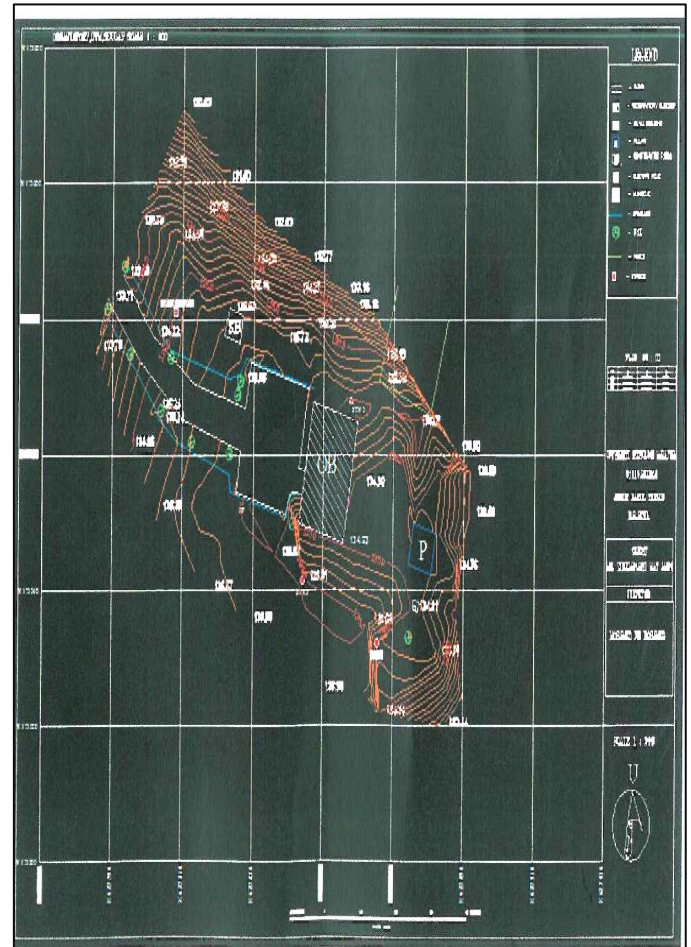


Figure 4 detail plan obtained from CDS and Imported into AutoCAD.

The results obtained from Carlson Survey 2009 Software are downloaded and processed in two forms. The two – dimensional detailed plan, GRID and TIN DTMs as well as the three – dimensional models in both TIN and GRID formats are viewed in the 3D model viewer in Carlson Software.

As shown in the Figure 6 the TN results show a network of triangles connected by vertices of elevation points as surveyed from the field work and effectively depicting the terrain and topology of the study area. Figure 7 shows the three dimensional model of the TIN version of results as depicted by Figure 6. 3D GRID representation Figure 9 tend to give a broader perspective of the topological qualities of the area surveyed while 2D GRID representation Figure 8 may sometimes have limited visual capabilities and may be hard to interpret or even un-interpretible to the untrained eye and no technical or experienced personnel. It is for this reason that the 3d representations are normally preferred despite their demand for more storage space.

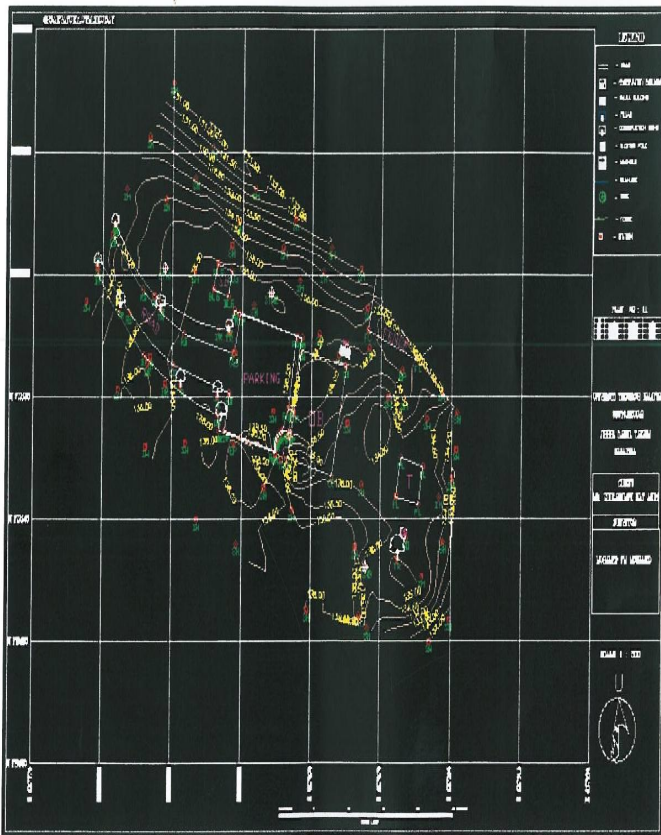


Figure 5 Detail plan from Carlson Survey 2009 Software.

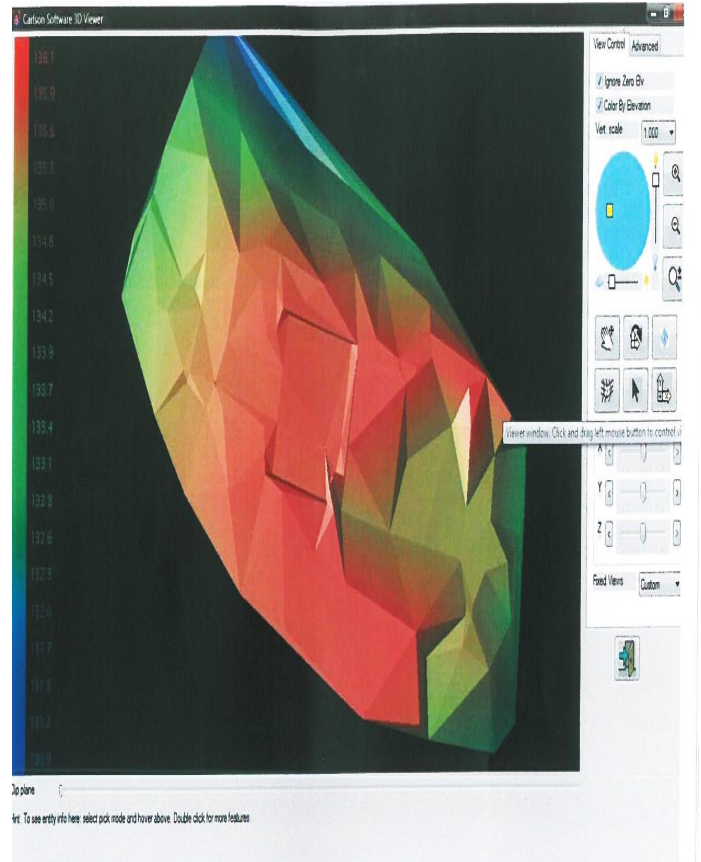


Figure 7 3D - TIN representation in Carlson Survey 2009 Software.

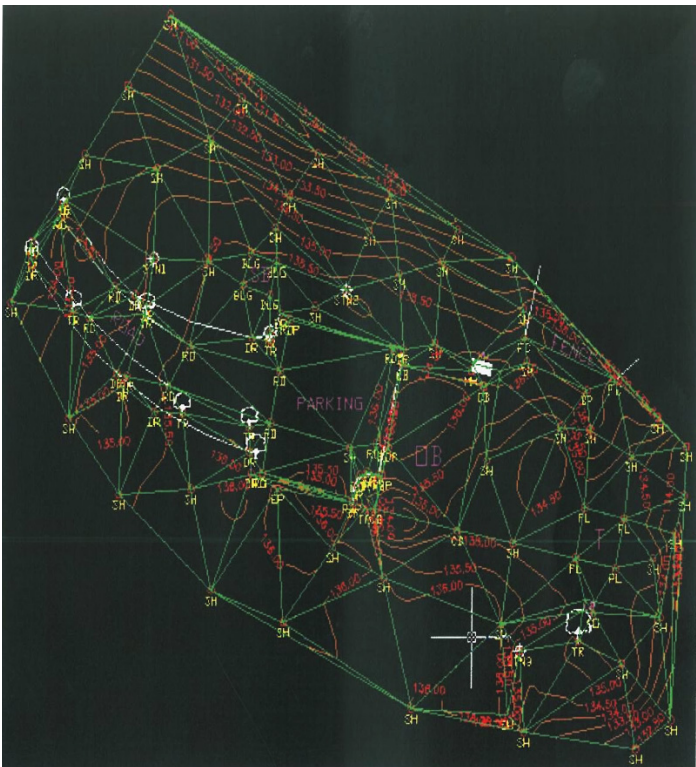


Figure 6 TIN representation in Carlson Survey 2009 Software.

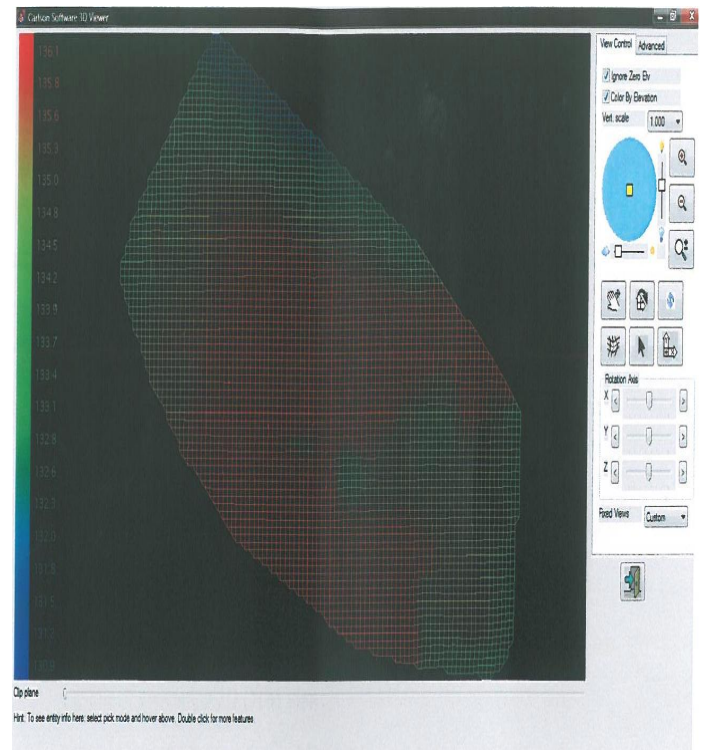


Figure 8 2D - GRID representation Carlson Survey 2009 Software.

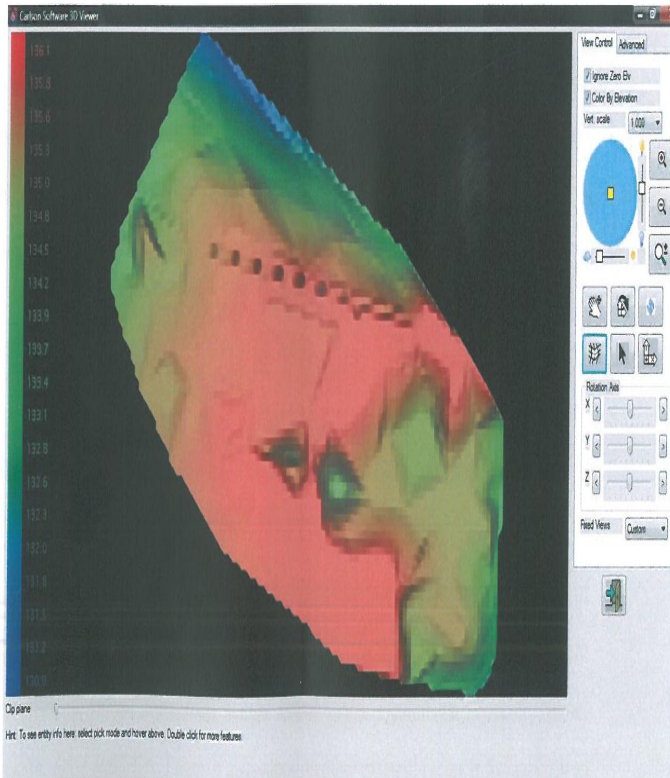


Figure 9 3D - GRID representation in Carlson Survey 2009 Software.

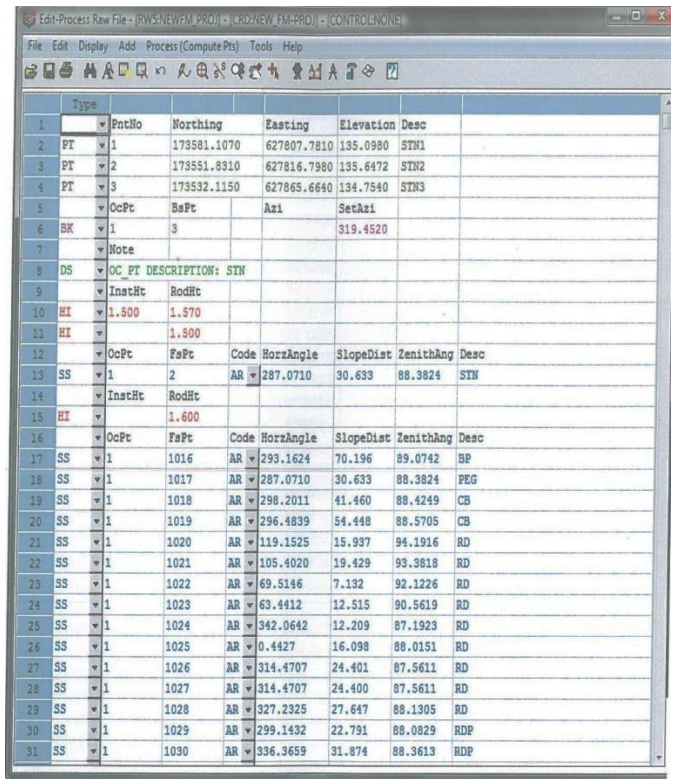


Figure 10 Carlson software – RW5 file from data download

Carlson software is capable in downloading raw data from various types of total station and external data recorder module. This software support 100 percent raw data download from total station brand Leica, Geodimeter, Topcon, Nikon sokkia, Zeiss and Laser. It also supports other external recorder format such as SurCE, SurvStar, G2, Dozer2000, TDS, SDR, Surveyors Assistant and Geodat.

Raw data that had been downloaded to this software be processes stored as raw data format file . It has been discovered that Carlson 2009 Software is easier to understand the raw data format. Rows and lines from detail survey will be arranged and marked clearly as shown in Figure 10. Every detail point’s information will be displayed completely as any point oriented, where it is faced, back station information, instrument and prism height, bearing, slope distance, vertical angle and detail code. The format is different with CDS software, where information on all detail is showed as basic in the stadia window like Figure 11. It showed all information needed in the survey data processing but needs great understanding to know the information array displayed.

Carlson Survey 2009 Software is not only capable of generating contour lines, but also capable of generating 3D dynamic view and from which height analysis can be carried out easily. Contour lines at field work can be generated without the user being prompted to manually generate the triangulation initially as required in the CDS software. This specification can fasten the generation of detail survey plan. Contour lines that have been

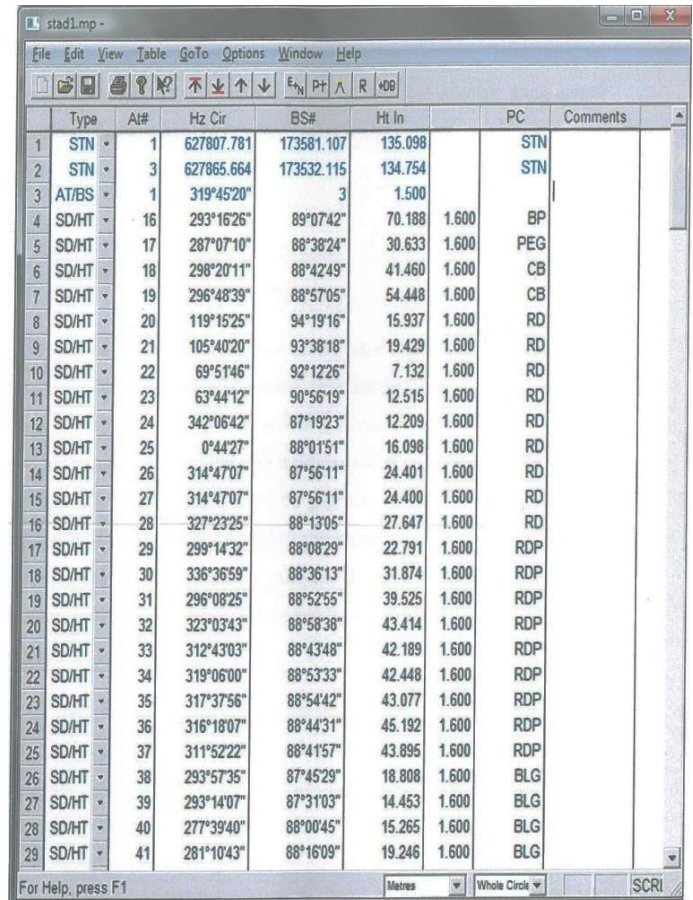


Figure 11 CDS software – the stadia file

generated can be fully manipulated like line smoothing, labeling, color changing, line width and type. All functions are in contour menu on DTM-contour module without worrying if contour lines damaged and there is no need to reprocess the contour.

Three dimensional DTM views can be generated via Carlson Survey 2009 Software. Accuracy on DTM generated is high and the users are able to have the option to choose the model method such as triangulation, kriging, polynomial, and least root mean square (can be viewed on Figure 6 and 8) However, CDS software can only use triangulation method to generate DTM. Dynamic three dimensional can be viewed on 3D viewer window and users can rotate X, Y and Z axes to view 3D clearer.

3D view generated by Carlson Survey 2009 Software (Figure.7) can be shown by color representations for every elevation. With different colors, users can make height analysis much easier only by using bare eye inspection, while CDS software is only capable of generating 3D view in one color (Figure 3) which is a major difference especially for data representation to non-skilled or non-technical personnel.

The usage of AutoCAD platform in this software makes graphical editing works much easier and faster. Users who have been familiar with AutoCAD environment will discover that Carlson software can help then in editing the plan two time faster. This because of the AutoCAD handicap such as LISP routine and editing toolbars plus new specifications on Carlson survey 2009 software, i.e. Annotate menu which helps completing detailed plan faster. Carlson Survey 2009 Software has the features that can help to draw legend, north direction, map frame, and grid boxes automatically. These features are not available in CDS software.

In the research, Carlson Survey 2009 Software is capable to plot any plan with any scales. This software uses interface plotter from AutoCAD software. In order to do checking, user can view the plans contain before it is actually platted using Full Preview button for whole checking and Partial Preview for partial checking. Table 1 shows a summary of the comparison between six aspects that are needed in any survey software to generate detail plan survey.

4. Conclusions and recommendations

Time for processing: whereas both software are capable of producing nearly identical results, the time for processing required for both greatly difference, In CDS the processing is done automatically in the CDS software suite but later needs to be exported to a CAD software such as AutoCAD for further and more refined editing this makes the process longer the Carlson Survey Software where the software is CAD based and tools for editing and processing are combined in the some suite.

Specification	Carlson Survey 2009	Civil Design and Survey (CDS)
Data download	Capable to download from various format of total station and electronic data recorder.	Also capable to receive various format of total station and electronic data recorder
Data processing	Easy to understand raw data format In Raw Editor RW5 windows	Need good perception to understand raw data format in stadia window
	Prepares six choices to do coordinate calculation i.e. latit dipat calculations, angel adjustment, compass, Crandall, transit and LSA	Prepares only two coordinate calculations method i.e. latit dipat calculation and LSA.
	Using Field to Finish command to process lines, polygon and points automatically.	Using Feature Code Library command to process lines. Polygons and point automatically.
Contour and DTM generation	Generate contour without prompting user to generate triangulation lines.	Requires user to generate triangulations lines before contour
	3D DTM is generated by triangulation, Kriging, Polynomial and least root mean square methods.	3D DTM is generated by triangulation method only
	DTM is represented with different color based on height. this will make height analysis much easier even by bare eyes.	DTM is represented only by green color. Height analysis by bare eyes is nearly impossible
Graphical editing	Uses AutoCAD interface for CAD graphical editing	Uses internal CAD. Less capability in generating good CAD file.
Plan Plotting	Capable to plot final plan with any wanted scale	Also capable to plot final plan with any wanted scale
Format changing	Changes to dxf. Format is not necessary as it uses AutoCAD platform	Changes to dxf. Format is necessary for further editing

Table 1 Comparison between Carlson Survey 2009 Software and CDS software

User input required: it is fairly difficult to draw a line between CDS and Carlson software when it comes to user input and expertise necessary but it is relatively and easy to conclude that in Carlson survey 2009 software the user is required is less than that necessary from start to finish for a project as compared to that required in CDS software however this question may be subjective the individual user and comfort as well as back ground of expertise. Civil Engineers used to working in AutoCAD will find Carlson Survey 2009 Software relatively easier compared to the CDS while surveyors may find using CDS easier in some cases despite its other shortcomings.

Suitability of Results: this aspects of the two software is totally subjective to the user requirements but based on the data and processing carried out in this project as well as the vast function, commands and editing capabilities available to user in Carlson Survey 2009 Software, the researchers is based to the reasoning that the result form Carlson Survey 2009 Software are most suitable than those that are obtained from CDS Software but this still remains to the user requirements and personal preferences of individual users.

From the analysis carried out in this research , the applications and capability of automation in engineering surveying has been studied and understood with reference to total station and two software namely ; CDS and Carlson survey 2009 from field data collection until the production of detailed maps.

Emphasis in the research was placed on the understanding and applications of Carlson survey 2009 software and its functionalities such as survey, surface and COGO menus and these have all, at one time applied to complete one task .

Some of the tasks :

1. Data collection, conversion and processing or edit directly via the edit process raw data file.
2. Contour plan and DTM generation
3. Plotting at different scales

The application were all effectively and impressively done in one package making Carlson survey 2009 software ideal for today's robust survey activities .

The platform of Carlson survey 2009 software given an ideal characteristic for user familiar with AutoCAD and easy to learn .also offered to be able to create contour plans and DTM easier and less time. The incorporated facilities such as LISP routine and toolbars for editing along with the addition of some new features in Carlson survey software itself for instance annotate menu used in classification .

Carlson survey 2009 software had ideal qualities for presentation of data in three dimensions (3D) as digital terrain models both smoothly and accurately based on the software's algorithm forms

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modeling such as triangulation, Kriging, polynomial and least squares estimation methods.

A comparison between CDS software to Carlson survey 2009 software reveled that while CDS has the capability of effectively representing the same it is limited to one method (triangulation) whereas Carlson survey is endowed with numerous methods even the gird method.

Carlson survey 2009 software is dedicated to providing the finest software to lands surveyors, civil engineers, mining engineers, and land development professionals making it ideal for use in today survey needs ranging where time and resources have to be effectively and efficiently managed.

The recommendations list drawn in this study as:

1. Carlson survey 2009 software to be applied and adopted as the overall engineering survey software by surveyors in Libya due to the numerous advantages and functionalities it presents to surveyors and engineers.
2. GIS module and menu in Carlson survey 2009 software can be used to establish the database for the engineering surveys on numerous project in Libya from road design to construction and can manage all contour plans, documents, coordinates and heights information, traverse and tachometry data and also boundaries marks location status. DTM can be used as the 3D base map for managing the information .
3. survNet menu for network least squares calculation which is essential for raw survey notes reduction. SuvNet handles any combination of total station , GPS and level loop measurement.
4. Carlson survey 2009 software combined the surveyors preferred language of point based coordinate geometry (COGO) commands within the AutoCAD drawing environment better than any other survey software in AutoCAD.
5. Hydrology module can be used in hydrographic survey to determine the thalweg for boundaries located along a river.
6. More research and studies be carried out in the engineering survey automation filed especially in other undeveloped in countries like Libya .
7. Used Carlson survey 2009 software in implementation and building of survey and information database from acquired and information processed which would in turn be used as a GIS or land information system for surveyors .

References

- [1] Anderson, J., Mikhail, E. (1998) Surveying Theory and Practice, 7th Edition (pp.44-52). Boston: WCB/McGraw-Hill.
- [2] Carlson Survey 2009 Embedded AutoCAD, User's manual.
- [3] Constructive surveying and layout. A step by step filed engineering methods manual by Wesley G. Carwford . 1995.
- [4] Craymer M.R., Wells D.E., Vanicek P. & R.L. Devlin, 1990, Specifications for urban GPS surveys. Surveying and Land Information Systems, 50(4), 251-259.

- [5] Elementary surveying 6th Edition 1977. Russell C. Brinker & Paul R. Wolf Thomas y. Crowell , Harper & Row , Publishers- New York
- [6] Jennifer DiBona (2013) Using Field to Finish with Carlson Survey & SurvCE, Maryland Society of Surveyors 2013 Fall Conference.
- [7] Jennifer DiBona (2014), New Jersey SurvCon 2014 Field to Finish And Surface Modeling with Carlson Survey
- [8] Jennifer DiBona (2016), Field to Finish for Survey and GIS Collection, PSLs Surveyors' Conference 2016 Pennsylvania Society of Land Surveyors.
- [9] Jivall L., 1992, GPS for geodetic control surveying in Sweden, 6th Int. Geodetic Symp. On Satellite Positioning, Columbus, Ohio, 17-20 March, 501-510.
- [10] Map Use and Analysis .4th edition. 2001 Campbell , J, McGraw- Hill. Higher education. 130, New York.
- [11] Surveying for engineering 3th edition 1994. J. Uren – department of civil engineering university of Leeds .& W.F,Price- department of civil engineering university of Brighton .
- [12] U.S. Army Corps of Engineers, Engineer Manual EM 1110-1-1002, Survey Markers and Monumentation, 1 March 2012
- [13] U.S. Army Corps of Engineers, Engineer Manual EM 1110-1-1003, NAVSTAR Global Positioning System Surveying , 28 February 2011
- [14] U.S. Army Corps of Engineers, Engineer Manual EM 1110-1-1005, Control and Topographic Surveying, 1 January 2007 .
- [15] User Guidelines for Single Base Real Time GNSS Positioning, Version 2.1(2011), William Henning, National Oceanic and Atmospheric Administration, National Geodetic Survey.

Evaluation of Three Evaporation Estimation Techniques In A Semi-Arid Region (Omar El Mukhtar Reservoir Sluge, Libya- As a case Study)

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ARTICLE INFO

Article history:

Received: 15 January, 2017

Accepted: 06 February, 2017

Online: 25 February, 2017

Keywords:

Modeling, Evaporation

Omar El Mukhtar Reservoir

Semi-arid region

Assessment

ANN

RSM

ABSTRACT

In many semi-arid countries in the world like Libya, drinking water supply is dependent on reservoirs water storage. Since the evaporation rate is very high in semi-arid countries, estimates and forecasts of reservoir evaporation rate can be useful in the management of major water source. Many researchers have been investigating the suitability of estimates evaporation rates methods in many climatic settings, infrequently of which were in an arid setting. This paper presents the modeling results of evaporation from Omar El Mukhtar Reservoir, Libya. Three techniques namely (artificial neural networks (ANN), Multiple linear regression (MLR) and response surface methods (RSM)) were developed, to assess the estimation of monthly evaporation records from 2001 to 2009; their relative performance were compared using the coefficient of determination (E), mean absolute percentage error (MAPE%), and 95% confidence interval. The key variables used to develop and validate the models were: monthly (precipitation R_f , average temperature $Temp.$, relative humidity R_h , sunshine hours $Sh.$, atmospheric pressure $Pa.$ and wind speed $Ws.$). The encouraging results approved that the models with more inputs generally had better accuracies and the ANN model performed superior to the other models in predicting monthly E_{vp} with high $E=0.86$ and low $MAPE\%= 13.9$ and the predicted mean within the range of observed 95CI%. In summary, it is revealed in this study that the ANN and RSM models are appropriate for predicting E_{vp} using climatic inputs in semi-arid climate.

1. Introduction

Evaporation is one of major components of the hydrologic cycle and it describes the loss of water from water bodies to the air over a long period to elucidate its relationship with annual precipitation. Estimation of evaporation rate is important in the study of hydrology, climate, agricultural water system, design and operation of irrigation systems. Many methods for estimation of evaporation losses from free water surfaces were reported and it can be divided into several categories including: (Empirical Methods, Water Budget Methods, Energy Budget Methods, Mass-Transfer Methods and Combination Methods) [1]. Accurate and reliable measurement of evaporation for a long term has been investigated by researchers. In deceit, an observation from Class A Pan evaporimeter and contemporary correlation techniques were used, in indirect methods, the evaporation is estimated from other meteorological variables like temperature, wind speed, relative humidity and solar radiation.

Recently, the advanced soft computing techniques have been successfully applied for modeling of hydrological data due to their ability to learn complex and non-linear relations .

In their study [2], the evaporation from Batu Dam Reservoir which is located at the Selangor state, Malaysia was estimated using artificial neural networks (ANN) and climate based models (Penman and Priestley-Taylor). The models output display that ANN-4 model was the best with the coefficient of efficiency (E) of 90%.

In [3], they studied, daily evaporation prediction were prepared by Penman equation, Levenberg-Marquardt algorithm based on "Feed Forward Back Propagation Artificial Neural Networks (LMANN)", radial basis neural networks (RBNN), generalized regression neural networks (GRNN). noticed that the results of neural network models were statistically more meaningful than the Penman equation.

At their investigation (ANN), Least Squares – Support Vector Regression (LS-SVR), Fuzzy Logic, and Adaptive Neuro-Fuzzy Inference System (ANFIS) techniques improve the accuracy of daily pan evaporation estimation in sub-tropical climates [4]. Meteorological data from the Karso watershed in India (consisting

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of 3801 daily records from the year 2000 to 2010) were used. Based on the comparison, it was found that the Fuzzy Logic and LS-SVR approaches can be employed successfully in modeling the daily evaporation process from the available climatic data.

In [5] the authors used the response surface method (RSM) to extend estimation of monthly pan evaporations using high-order response surface (HORS) function. A HORS function was proposed to improve the accurate predictions with various climatic data, from two stations, Antalya and Mersin, in Mediterranean Region of Turkey. The HORS predictions were compared to artificial neural networks (ANN), neuro-fuzzy (ANFIS) and fuzzy genetic (FG) methods in these stations. Comparison results indicated that HORS models performed slightly better than FG, ANN and ANFIS models.

In [6], the authors investigate the abilities of six different soft computing methods, Multi-layer perceptron (MLP), generalized regression neural network (GRNN), fuzzy genetic (FG), least square support vector machine (LSSVM), multivariate adaptive regression spline (MARS), adaptive neuro-fuzzy inference systems with grid partition (ANFIS-GP), and two regression methods, multiple linear regression (MLR) and Stephens and Stewart model (SS) in predicting monthly E_p . Long-term climatic data at eight stations in different climates, during 1961-2000 were used. The accuracies of above models ranked as: MLP, GRNN, LSSVM, FG, ANFIS-GP, MARS and MLR. Generalized models were also developed and tested with data of eight stations.

The situation in Libya is typical of semi-arid climate, with average annual rainfall of less than (100 mm) and average annual evaporation is estimated to be (2500 mm) which is much higher than the rainfall [7]. This highlights the seriousness of water losses problem from open water bodies. In the Great-Man-Made-River-Project there are many of this type of open reservoirs, such as the Omar Mukhtar Open Reservoir. Over 20% of the total Omar Mukhtar Open Reservoir's water storage capacity, (4.7Mm³), is lost due to the evaporation phenomena.

Thus, the objectives of this study are to assess the estimates of the evaporation using three techniques against observed evaporation values for Omar Mukhtar Reservoir which is located in semi-arid region. Investigation of the capability and usability of three different soft computing methods, artificial neural networks (ANN), Multiple linear regression (MLR) and response surface methods (RSM) in modeling of the monthly evaporation (Evp.) for Omar Mukhtar open Reservoir. The meteorological data used to estimate the evaporation was acquired from the meteorological observatory included: average air temperature (Temp. C⁰), relative humidity (Rh.%), atmospheric pressure (Pa. Pas), wind speed (Ws. Knot), sunshine hours (sh. hr), rainfall (Rf. mm). The evaporation from the pan was multiplied by a factor of (0.73) to get the actual evaporation. Eight years of monthly evaporation recorded from 2001 to 2009 (108 value) were used to in this study. The model performances was compared and discussed through: estimating (Evp.) of each month using ANN, MLR, and RSM models. This will be the first study to compare the accuracy of multiple soft computing models (Evp.) estimation for open reservoir (Omar El Mukhtar) at semi-arid climates.

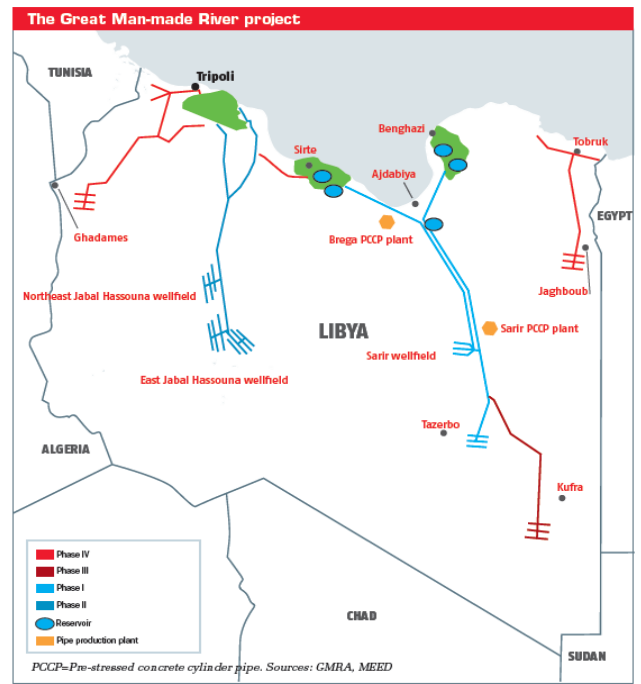


Figure 1 The man made river map.

2- Materials And Methodology

1.1. Study Area:

Omar El Mukhtar tank is located at a distance of (45 Km) from the south-east of the city of Benghazi. Create reservoir in the form of free rock fill dam circular shape up (9 m) and a length of (3.2 km) circumference; diameter up to (960 m) from the top as rise in the bottom of the tank from the surface level Sea about (55 m) and the maximum level of the run up to (63.5 m) from the surface level Sea, so that a total capacity of (4.7 Mm³) of water, and space surface of the reservoir is approximately (750,000 m²) see Figure 1 and 2. construct the reservoir layer clay sealing parasitic in nature, and to prevent leakage of water through the rock fill dam was a protective membrane.



Figure 2 Omar El Mukhtar reservoir

1.2. Study Methodology:

MLR is a technique utilized to model the linear relationship between a dependent variable and one or more independent variables. The dependent variable is sometimes additionally called the predictor. MLR is depended on least squares methods . The model is fit such that the sum of squares of differences of estimated and observed values is minimized. MLR probably the most widely used method in hydrology and climatology for developing models to reconstruct or analysis the long-term variations of climatic factors.

MINITAB software programing omits all observations that contain missing values in the response or in the predictors, from calculations of the regression equation and the ANOVA table items. By default, a y-intercept term is included in equation. Thus, MINITAB fits the model However, if the response at x = 0 is naturally zero, a model without an intercept can make sense. If so, choose to not fit an intercept, and the β_0 term will be omitted. Equation 1 provide the general formula for MLR:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_k x_n + \epsilon \quad -1$$

Where:

y= the predicted value (Evp.)

x_1, x_2, \dots, x_n = the inputs (Temp, Rh, --etc.)

$\beta_0, \beta_1, \beta_2, \dots, \epsilon$ = random error representing the combined effects of variables

Response surface methodology (RSM) consists of a set of statistical methods that can be used to develop, improve, or optimize products. RSM typically is used in situations where several factors influence one or more performance characteristics, or responses. There are three general steps that comprise (RSM): experiment design, modeling, and optimization. Choosing the design correctly will ensure that the response surface is fit in the most efficient manner. MINITAB provides central composite and Box-Behnken designs see Figure 3 .

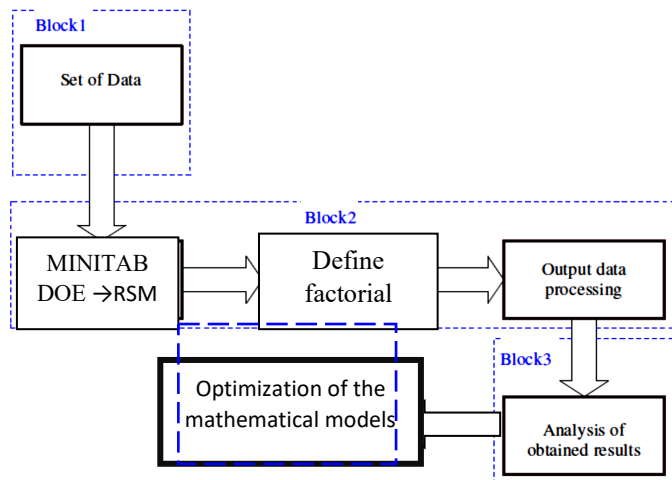


Figure 3. The RSM Diagram.

The empirical models were fit to the data, and polynomial models (linear or quadratic) typically were used. The Equation illustrates the general case of the full quadratic model for k=3 as an example for independent variables see Equation .2:

$$y = b_0 + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_{12} x_1 x_2 + b_{13} x_1 x_3 + b_{23} x_2 x_3 + b_{11} x_1^2 + b_{22} x_2^2 + b_{33} x_3^2 + e \quad - 2$$

In this equation, the ten coefficients are represented by the b_k and e is a random error term representing the combined effects of variables not included in the model. The interaction terms ($x_i x_j$) and the quadratic terms (x_i^2) account for curvature in the response surface [8].

Artificial Neural Networks (ANN) , are a form of computing inspired by the functioning of the brain and nervous system, and discussed in detail in a number of hydrologic papers [9]. The feed forward ANN has been adopted in many hydrological modeling studies because of its applicability to a variety of different problems [4]. Noted that more than one hidden layer may require in feed forward networks because a three-layer network can generate arbitrarily complex decision regions. Also, the appropriate input vector to the ANN model can be identified according to the procedure of the modeler. Back propagation is the most popular algorithm used for the training of the feed forward ANN. An objective function that considers both the ANN's structure and error, minimizes a linear combination of the resulting ANN's squared errors, weights, and biases in order to develop a less complex model at the end of training the resulting network has good generalization qualities.

The Levenberg–Marquardt (LM) training algorithm is a trust region based method with a hyper-spherical trust region [9]. This algorithm was implemented in this study using the Neural Network Toolbox of MATLAB, an example of Developed Structure of ANN with input combination as in Figure 4.

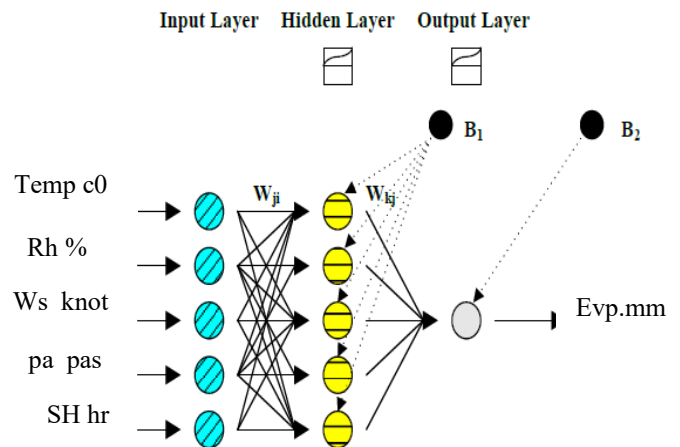


Figure 4. Developed Structure of ANN with input combination 5

1.3. Comparative Statistics

In this study, several statistical parameters were used to evaluate the performance of predicted models, which were given by the following relations [9]:

1- Mean absolute percentage error (MAPE%)

$$MAPE\% = \frac{100}{n} \sum_{i=1}^n \left| \frac{Evp.obs. - Evp.pre.}{Evp.obs.} \right| \quad -3$$

2- 95% confidence limit (95CI%):

Standard error of the mean is given as

$$S_x = \frac{s}{\sqrt{n-1}}$$

The quantity $(Evp. - \mu) / S_x$ has a t-distribution with $n-1$ degrees of freedom, And for 95% confidence limit

$$Evp. - 1.95 \left(\frac{s}{\sqrt{n-1}} \right) < \mu < Evp. + 1.95 \left(\frac{s}{\sqrt{n-1}} \right) \quad -4$$

The value on the left side of the inequality yields the lower limit, and on the right side yields the upper limit for the mean

3- E Efficiency factor:

$$E = 1 - \frac{\sum_{i=1}^n (Evp.obs._i - Evp.pre._i)^2}{\sum_{i=1}^n (Evp.obs._i - \overline{Evp.obs.})^2} \quad -5$$

Where:

n = number of data

$Evp.obs.$ = observed evaporation data

$Evp.pre.$ = predicted evaporation data

S = standard deviation

$\overline{Evp.obs.}$ = the mean of evaporation data.

A better fit, with zero indicating MAPE% and high value of E a perfect prediction. Efficiency factor ($E = 0$ to 1) is calculated on the basis of the relationship between the predicted and observed mean deviations and it can show the correlation between the predicted and observed data. E is better suited to evaluate model goodness-of-fit than the R^2 (the square root of the correlation coefficient between the predicted and observed value). The probability of procedure produces an interval that contains the actual true parameter value is known as the Confidence Level and is generally chosen to be 95CI%. So the model if have a good performance well produce a results within the range of 95CI% of the mean observed evaporation data. The models are used to

generate evaporation data which conserve the main statistical characteristics of the historical data. This is verified through comparing values of mean, of generated evaporation data with those of historical data .

4. Predicting Monthly Evaporations of Omar Muktar Open Reservoir:

In this study, monthly climatic data at Omar Muktar Open Reservoir (is in the zone of semi-arid climate) were used for developing and testing Evp. models. Figure 5 shows the histogram distribution of the evaporation data with the basic statistical information details. The data used in this research cover 8 years (2001-2009) of monthly records of average air temperature (Temp. c0) , relative humidity (Rh.%), atmospheric pressure (Pa. pas), wind speed (Ws. knot), sunshine hours (sh. hr), rainfall (Rf. mm) pan evaporation (Evp.mm³). Figures 6,7,8, and 9 showing the variation of the evaporation to the climatic parameter using in this study . Table 1 showed the monthly of mean, standard deviation, minimum and maximum values of climatic parameters, respectively.

Table 1. The Statistical Data Information

Variable	Mean	StDev	Minimum	Maximum
Temp max c0	25.29	5.791	15.2	33.8
Temp min c0	15.541	4.929	7.1	24.6
Rh %	63.361	8.224	38	80
Ws knot	11.838	1.742	7.5	17.1
Sh hr	9.069	2.339	3.89	12.95
Pa pa	999.75	8.39	925	1010.3
Rf mm	20.17	26.56	0	107.2
Evp.mm ³	98065	40358	7263	190039

StDev, denote the standard deviation.

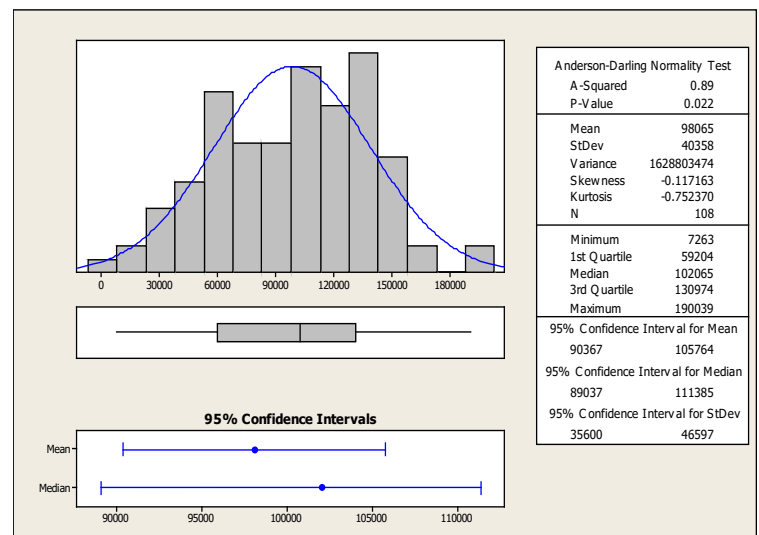


Figure 5 Monthly evaporation data mm3 for (2001 to 2009) at Omar Muktar Open Reservoir

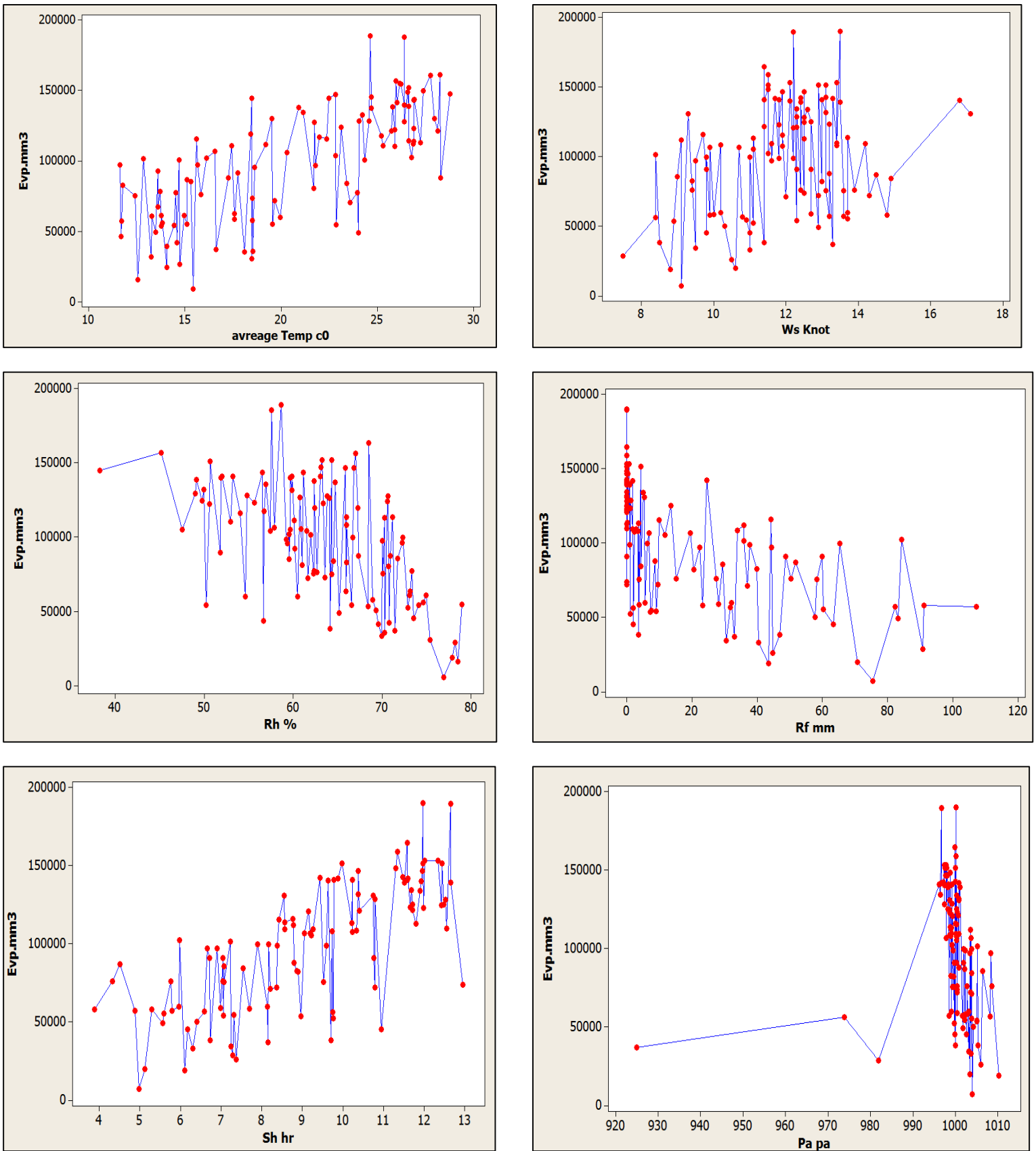


Figure 6 Monthly variations of the climatic parameter and the evaporation for 2001 to 2009. at Omar Muktar Open Reservoir.

80% of the whole data was chosen for training the Evp. models and the remaining data used for testing the models. Multiple liner regression (MLR) was employed by MINITAB (Ver.16) software package to develop the (MLR) pan evaporation models. The performance including both the accuracy and agreement of the MLR methods were evaluated through different

input combinations see Table 3. The comparative statistics i.e, MAPE, 95%, and E, used to illustrate the performance of proposed MLR functions and the best performance was compared with the RSM, and ANN models. Is clear from the Table 3 that the models with full weather inputs have the best accuracy.

Table 3. Error statistics for input combinations using MLR model in test and validation stage.

Input combinations	RSM equations	MPE%	E	The Evp. predicted average	95% CI
Average Temp	$Evp = 28166.1 + 590.1 \text{ average Temp} + 127 \text{ average Temp}^2$	37.68	0.56	98384.74	90367-105764
Average Temp, Rh	$Evp = 96503 + 30135 \text{ average Temp} - 38006Rh + 40573 \text{ average Temp}^2 - 16158 Rh^2 + 17149 \text{ average Temp} \times Rh$	30.38	0.63	98287.13	
Average Temp, Rh, Ws	$Evp = -53676 - 25784.5 \text{ average Temp} + 6742Rh + 30185Ws + 496 \text{ average Temp}^2 - 51.7 Rh^2 - 560.9Ws^2 + 82.4 \text{ average Temp} \times Rh + 362.8 \text{ average Temp} \times Ws - 307.3 Rh \times Ws$	29.40	0.67	98006.74	
Average Temp, Rh, Ws, Sh	$Evp = -120380 - 64350 \text{ average Temp} + 6627Rh + 29935Ws + 104232 Sh + 228 \text{ average Temp}^2 - 52 Rh^2 - 423 Ws^2 - 3341Sh^2 + 443 \text{ average Temp} \times Rh + 10095 \text{ average Temp} \times Ws + 1948 \text{ average Temp} \times Sh - 259Rh \times Ws - 858Rh \times Sh - 2181Ws \times Sh$	25.60	0.71	98264.62	
Average Temp, Rh, Ws, Sh, Pa	$Evp = -96000383 - 48835 \text{ average Temp} + 265403Rh + 956470Ws + 1044870 Sh + 157108 Pa + 223 \text{ average Temp}^2 - 29 Rh^2 - 115 Ws^2 - 3145Sh^2 - 61Pa^2 + 365 \text{ average Temp} \times Rh + 1875 \text{ average Temp} \times Ws + 1059 \text{ average Temp} \times Sh - 13 \text{ average Temp} \times Pa - 160 Rh \times Ws - 1009Rh \times Sh - 259Rh \times Pa - 4828Ws \times Sh - 934Ws \times Pa - 882Sh \times Pa$	23.30	0.72	97925.05	
Average Temp, Rh, Ws, Sh, Pa, Rf	$Evp = -49477746 - 302619 \text{ average Temp} + 66184Rh + 751764Ws + 694092 Sh + 87555 Pa - 39888Rf + 272 \text{ average Temp}^2 - 45 Rh^2 + 103 Ws^2 - 2162Sh^2 - 38Pa^2 + 5Rf^2 + 598 \text{ average Temp} \times Rh + 1908 \text{ average Temp} \times Ws + 1567 \text{ average Temp} \times Sh + 221 \text{ average Temp} \times Pa - 63 \text{ average Temp} \times Rf + 32 Rh \times Ws - 1220Rh \times Sh - 64Rh \times Pa + 14Rh \times Rf - 3828Ws \times Sh - 755Ws \times Pa + 12Ws \times Rf - 565 Sh \times Pa + 438Sh \times Rf + 37 Rf \times Pa$	21.53	0.73	97794.92	

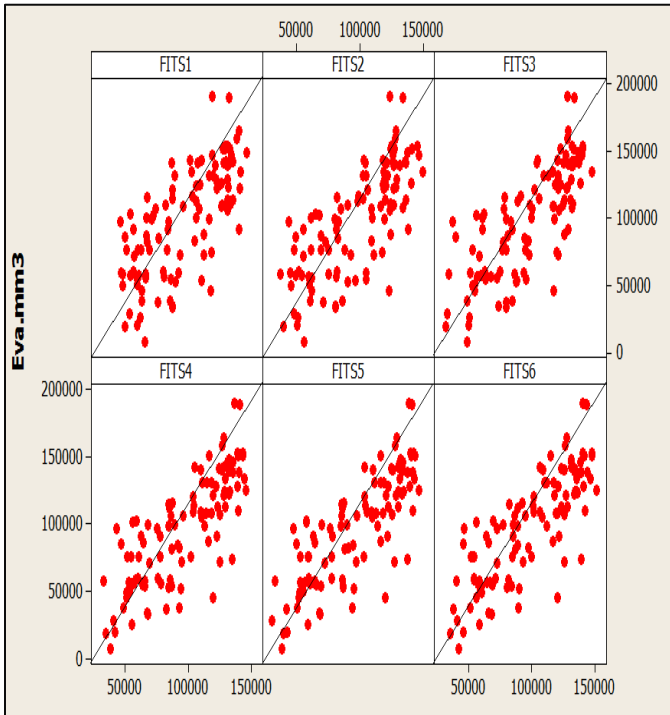


Figure 7. The observed and estimated pan evaporation using MLR (2001 to 2009) at Omar Muktar Open Reservoir.

A response surface (RSM) function was proposed with simple formulation to estimate the pan evaporations using climatic input variables. The RSM function was extended on order of polynomial functions based on input variables more than two. In this approach, the polynomial functions were simply and directly calibrated based on the observed climatic data and relative of evaporation data for each input combination. RSM models were

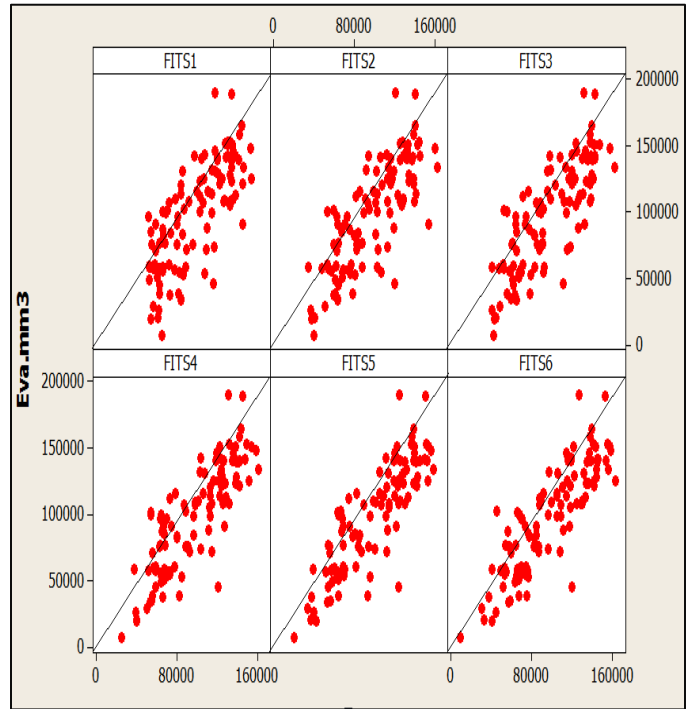


Figure 8. The observed and estimated pan evaporation using RSM (2001 to 2009) at Omar Muktar Open Reservoir

compared with each other based on input variables combination see Table 4. These result revealed that the RMS models were much simpler and could successfully use in estimating monthly pan evaporations. The full input RSM models provided results close to observed pan evaporation based on E, MAPE%, 9%CI, see Figure 8 .

Table 4. Error statistics for input combinations using RSM model in test and validation stage.

Input combinations	RSM equations	MPE%	E	The Evp. predicted average	95% CI
Average Temp	$Evp = 28166.1 + 590.1 \text{ average Temp} + 127 \text{ average Temp}^2$	37.68	0.56	98384.74	90367--105764
Average Temp, Rh	$Evp = 96503 + 30135 \text{ average Temp} - 38006Rh + 40573 \text{ average Temp}^2 - 16158 Rh^2 + 17149 \text{ average Temp} \times Rh$	30.38	0.63	98287.13	

Input combinations	RSM equations	MPE%	E	The Evp. predicted average	95% CI
Average Temp, Rh, Ws	$Evp = -53676 - 25784.5 \text{ average Temp} + 6742Rh + 30185Ws + 496\text{average Temp}^2 - 51.7 Rh^2 - 560.9Ws^2 + 82.4 \text{ averageTemp} \times Rh + 362.8\text{averageTemp} \times Ws - 307.3 Rh \times Ws$	29.40	0.67	98006.74	
Average Temp, Rh, Ws, Sh	$Evp = -120380 - 64350\text{average Temp} + 6627Rh + 29935Ws + 104232 Sh + 228\text{average Temp}^2 - 52 Rh^2 - 423 Ws^2 - 3341Sh^2 + 443 \text{ averageTemp} \times Rh + 10095\text{averageTemp} \times Ws + 1948\text{averageTemp} \times Sh - 259Rh \times Ws - 858Rh \times Sh - 2181Ws \times Sh$	25.60	0.71	98264.62	
Average Temp, Rh, Ws, Sh, Pa	$Evp = -96000383 - 48835 \text{ average Temp} + 265403Rh + 956470Ws + 1044870 Sh + 157108 Pa + 223\text{average Temp}^2 - 29 Rh^2 - 115 Ws^2 - 3145Sh^2 - 61Pa^2 + 365 \text{ averageTemp} \times Rh + 1875\text{averageTemp} \times Ws + 1059\text{averageTemp} \times Sh - 13\text{averageTemp} \times Pa - 160 Rh \times Ws - 1009Rh \times Sh - 259Rh \times Pa - 4828Ws \times Sh - 934Ws \times Pa - 882Sh \times Pa$	23.30	0.72	97925.05	

Input combinations	RSM equations	MPE%	E	The Evp. predicted average	95% CI
Average Temp, Rh, Ws, Sh, Pa, Rf	$Evp = -49477746 - 302619 \text{ average Temp} + 66184Rh + 751764Ws + 694092 Sh + 87555 Pa - 39888Rf + 272\text{average Temp}^2 - 45 Rh^2 + 103 Ws^2 - 2162Sh^2 - 38Pa^2 + 5Rf^2 + 598 \text{ averageTemp} \times Rh + 1908\text{averageTemp} \times Ws + 1567\text{averageTemp} \times Sh + 221\text{averageTemp} \times Pa - 63\text{averageTemp} \times Rf + 32 Rh \times Ws - 1220Rh \times Sh - 64Rh \times Pa + 14Rh \times Rf - 3828Ws \times Sh - 755Ws \times Pa + 12Ws \times Rf - 565 Sh \times Pa + 438Sh \times Rf + 37 Rf \times Pa$	21.53	0.73	97794.92	

The ANN models were trained using Bayesian Regularization (BR) and Levenberg–Marquardt (LM) algorithms. In ANN models the number of neurons in the hidden layer were found by a trial and error procedure. The activation functions used for the hidden and output layers were the ‘logsig’ and ‘purelin’ functions, respectively. Table 5 showing the structure of ANN models according to the input combination, moreover the models were improved by the accuracy with respect to MAPE%,E,CI 95%. ANN(6,10,1) model indicates model having 6, 10 and 1 for the input, hidden and output, respectively and the data divided in to (86 values for model training,5 values for model validation,5 values for model testing). Over all ANN showing best prediction for all input combination in both test and validation periods. Figure 10 showing the comparison between the predicted and observed evaporation data.

The best architecture was obtained for ANN evaporation model (ANN 6-10-1) has been selected based on minimum value of MSE and maximum value of E. The output from the best selected architecture for the ANN-6 model was validated using the testing data set (2008 to 2009). The objective of the validation process is to investigate the ability of the model to work with an independent data series that have not been used in training of the evaporation model.

In this study, models with different local input combinations were compared with each other in estimating Evp for (2001-2009). The results showed that the models with more inputs generally have better accuracies.

The ANN model performed superior to the other models in predicting monthly Evp at most inputs used, with respect to

MAPE%, E and 95CI %. ANN methods provide the best estimations, and can be used successfully also RSM . These two new methods provide a promising new approach for evaporation estimation in semi-arid climates. The best performance results obtained presented at Table 6 also figures 10,11,12and 13.

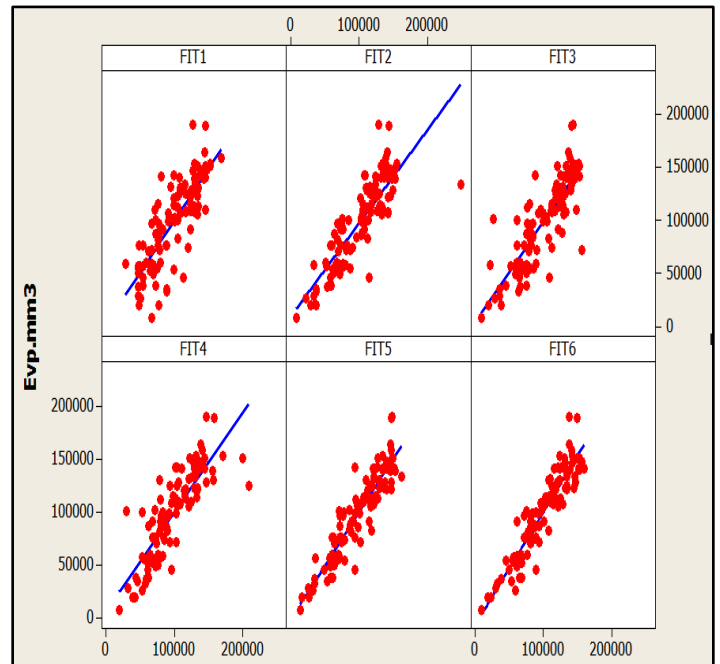


Figure 9. The observed and estimated pan evaporation using ANN (2001 to 2009) at Omar Muktar Open Reservoir

Table 5. Error statistics for input combinations using ANN models in test and validation stage.

Input combinations	ANN Model architecture	MPE%	E	The Evp. predicted average	95% CI
Average Temp	ANN1 (1,10,1)	32.85	0.66	98294.44	90367--105764
Average Temp, Rh	ANN 2 (2,10,1)	18.99	0.71	100922.04	
Average Temp, Rh, Ws	ANN3 (3,10,1)	19.86	0.70	99092.96	
Average Temp, Rh, Ws, Sh	ANN 4 (4,10,1)	22.08	0.71	97280.65	
Average Temp, Rh, Ws, Sh, Pa	ANN5 (5,10,1)	14.57	0.85	98217.31	
Average Temp, Rh, Ws, Sh, Pa, Rf	ANN 6 (6,10,1)	13.90	0.86	97350.46	

Table 6. Error statistics for best performance of ANNs, MLR and RSM models in test and validation stage.

The model	MPE%	E	The average predicted Evp. mm3	95% CI Observed Evp mm3
MLR -6	29.46	0.65	97758.85	90367—105764
RSM -6	21.53	0.73	97794.92	

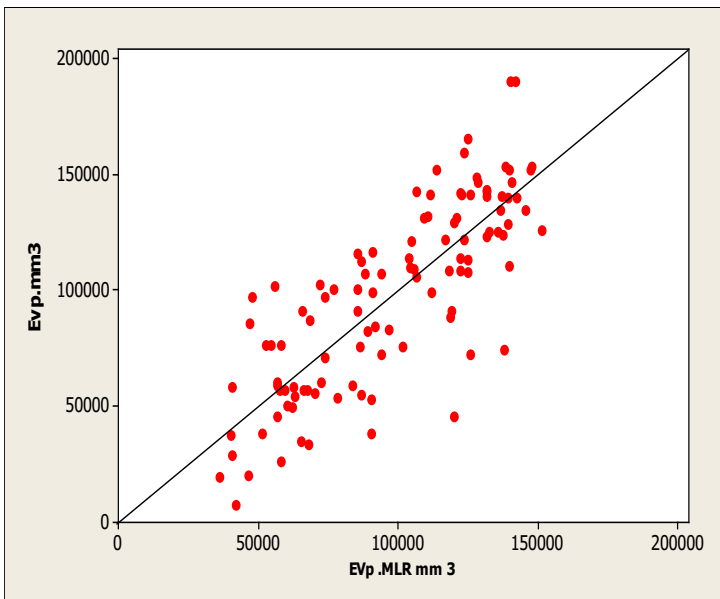


Figure 10. Comparison of the observed and estimated Evp using MLR-6 model during the training and testing period.

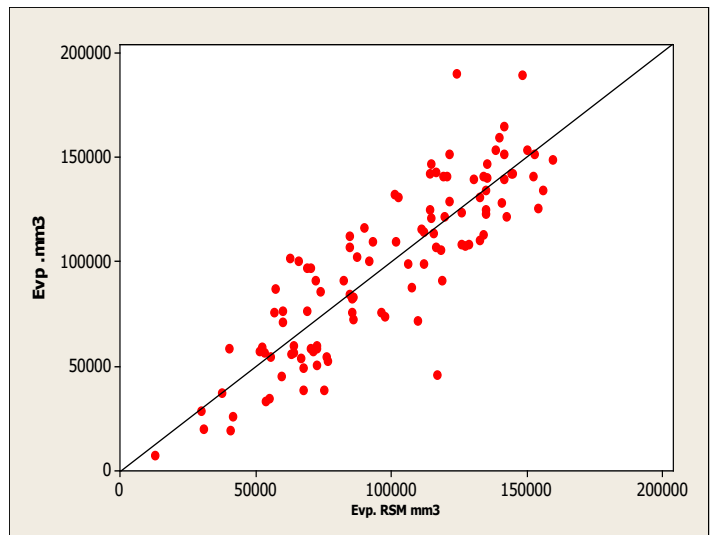


Figure 11. Comparison of the observed and estimated Evp using RSM-6 model during the training and testing period.

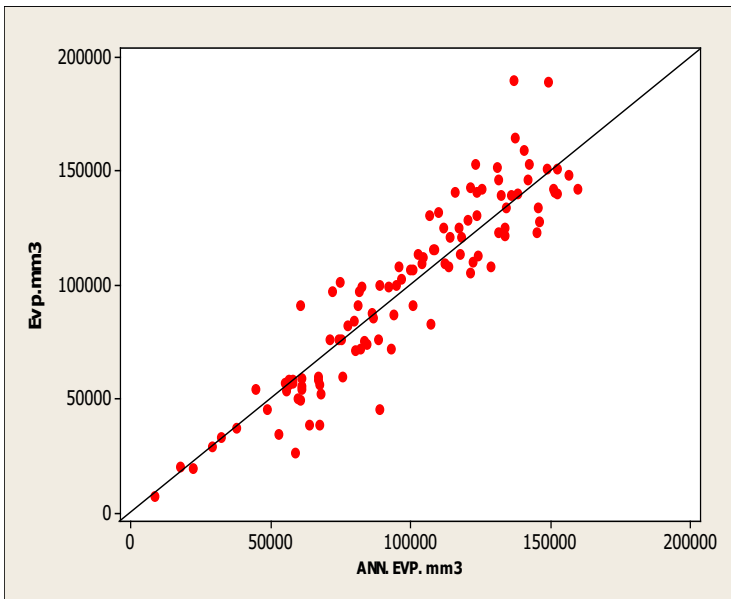


Figure 12. Comparison of the observed and estimated Evp using ANN-6 model during the training and testing period.

Noted that, Some of unusual observation evaporation value, all models yielded a results lower than it, also closed together, that mean there was a problem when measured these value see Figure 13 highlighted by red circle (2003, 2004, 2007).

4- Conclusion

This study investigated and compared the abilities of three different soft computing techniques, MLR, RSM, and ANN in modeling Evp. using different climatic input combinations of (average Temp, Rh, Sh, Ws , Pa and Rf). The climatic data obtained from Omar Muktar Open Reservoir (zone of semi-arid climate) were used for training and testing Evp. models. The models with different local input combinations were compared with each other in estimating monthly Evp. The results showed that the models with more inputs generally have better accuracies and the ANN model performed superior to the other models in predicting monthly Evp with high E=0.86 and lowest MAPE= 13.9% and have predicted mean within the range of observed 95CI%, also, the RSM model performed good . In summary, it was revealed in this study that the ANN and RSM models were appropriate for predicting monthly Evp using climatic inputs in semi-arid climate. The present applications can be practically adopted in the field of water resources management for accurately mapping regional distributions of evaporation and related water resource open storages.

REFERENCES

[1] Fekih, M., Bourabaa, A. and Mohamed, S., 2013, Evaluation of two methods for estimation of evaporation from Dams water in arid and semi-arid areas in Algeria, International Journal of Application or Innovation in Engineering & Management (IJAIEEM), 2, 376-381, ISSN 2319 – 4847.

[2] Benzaghta, M. A., Mohammed, T. A. and Ekhmaj, A. I., 2012, Prediction of Evaporation from Algardabiya Reservoir, Libyan Agriculture Research Center Journal International ,3,120-128 , ISSN 2219-4304.

[3] Dalkılıç, Y., Okkan, U. and Baykan, N., 2014, Comparison of Different Ann Approaches in Daily Pan Evaporation Prediction, Journal of Water Resource and Protection, 6, 319-326. <http://dx.doi.org/10.4236/jwarp.2014.64034>.

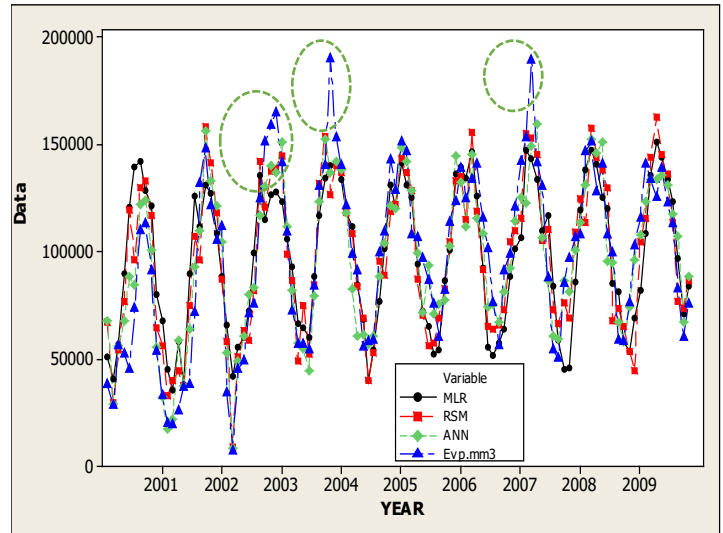


Figure 13. monthly evaporation values observed and predicted by ANN-6, RSM-6, MLR-6 model for (2001 to 2009) at Omar Muktar Open Reservoir.

[4] Goyal, M. K., Bharti, B., Quilty, J. c, Adamowski, J. and Pandey, A., 2014, Modeling of daily pan evaporation in sub tropical climates using ANN, LS-SVR, Fuzzy Logic, and ANFIS, Expert Systems with Applications, 41 , 5267–5276.

[5] Behrooz Keshtegar, and Ozgur Kisi , 2016, A nonlinear modelling-based high-order response surface method for predicting monthly pan evaporations, Hydrol. Earth Syst. Sci. Manuscript under review , CC-BY 3.0 License.

[6] Wang, L., Kisi, O., Z.-Kermani, M., and Gan, Y., 2016 , Comparison of six different soft computing methods in modeling evaporation in different climates, Hydrol. Earth Syst. Sci. Manuscript under review. CC-BY 3.0 License.

[7] Benzaghta, M. A. , Mohammed, T. A., Ghazali, A.H. and Soom, M. A., 2012 Prediction of evaporation in tropical climate using artificial neural network and climate based models , Scientific Research and Essays ,36, 3133-3148, ISSN 1992-2248 .

[8] Alsanusi, S., Bentaher, L., 2015, Prediction of Compressive Strength of Concrete from Early Age Test Result Using Design of Experiments (RSM)", International Journal of Civil, Environmental, Structural, Construction and Architectural Engineering, 9 ,1522-1526.

[9] Elmazoghi, H. G., Karakale, V. and Bentaher, L., 2016, Comparison of neural networks and neuro-fuzzy computing techniques for prediction of peak breach outflow, Journal of Hydroinformatics , 18,724-740.

Computer Aided Medical Diagnosis for the Treatment of Sexually Transmitted Disease (Gonorrhoea)

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ARTICLE INFO

Article history:

Received: 19 January, 2017

Accepted: 06 February 2017

Online: 25 February, 2017

Keywords:

Structured systems analysis

Treatment

Sexually transmitted diseases

Expert systems

ABSTRACT

The World Health Organization (WHO) report on the circumstances of clinical facilities in developing countries indicates that, there is considerable efficient delivery of medical services to the rural inhabitants where the services are available, these services are very expensive and not affordable to the average citizen. This has risen inadequacies such as prolonged suffering and even death. The slow process of diagnosis trial and error of diseases can be disastrous when a patient is at the advanced stage of a disease. Here we propose an automated system that can aid the diagnosis of sexually transmitted diseases and suggest adequate drug prescriptions and treatment. To achieve this, an extensive review on related diseases were reevaluated and a common type (gonorrhoea) was used as an exemplary study. This is based on the Structure Systems Analysis and Design Methodology (SSADM). The paper as shown a system that is most effective and have a fast way of diagnosing and treating sexually transmitted diseases, which serves as a great relief for the doctors and even non-experts in the field.

1. Introduction

Recently, assessment of the WHO study on the condition of clinical facilities in developing countries suggest that there is considerable efficiency in the provision of medical services particularly to the rural dwellers where the services are available, they are very expensive and unaffordable to the average citizen. This has resulted in prolonged suffering and death. Moreover, the slow process of diagnosis trail and error of disease can be fatal when a patient is at terminal point of his disease. The diagnosis and treatment of Sexually Transmitted Diseases is what the researcher deemed very important, since the practice of prostitution both at local and international level and widespread promiscuity among our teenagers, youths and even married ones in on geometric increase. The sexually transmitted disease (STD) is a group of diseases transmitted during sexual intercourse or close sexual contact with an infected person such Sexually Transmitted Disease includes Syphilis, Gonorrhoea, Chancroed, Non Gonococcal Urethritis in the male, Trichomonal Vaginitis in the female, Herpes Genitalis, Condylomata Accuminata, Molluscum Contagiosum and lately the Acquired Immune Deficiency Syndrome (AIDS) [6]. In this project, the researcher's interest will only be based on the called Gonorrhoea.

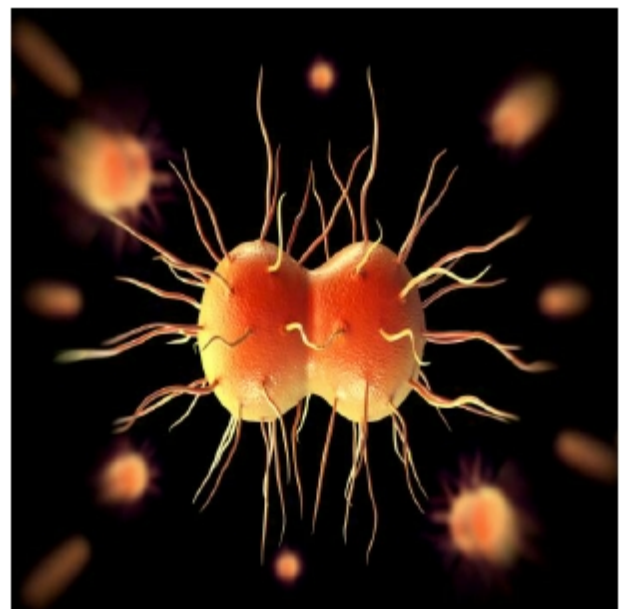


Fig. 1: The gonorrhoea bacteria: Courtesy Google Images

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1.1 Gonorrhoea

This is a sexually transmitted infection due to *Neisseria Gonorrhoea* (the gonococcus) (Figure 1), which effects primarily the anterior urethra in the male and the urethra and cervix in female. In recent years there has been a great increase in the cases of gonorrhoea throughout the world; approximately 60,000 cases are seen annually in the clinics of England and this figure is even higher in the case of Nigeria and other African countries.

After three to five days incubation period in male, the following symptoms and signs will be observed; Dysuria, Urethral discharge (i.e Seropurulent becoming purulent and yellowish) Reddening of urethral meatus etc. Gonococcal proctitis common in male homosexuals and is often symptomless.

In female, Gonorrhoea is frequently a symptomatic and may never be diagnosed on clinical grounds. Almost three quarters of all female patients attend initially as contacts of male cases and not because of their signs or symptoms. The signs and symptoms in female includes slight dysuria, slight or moderate vaginal discharge, which is often unnoticed by patient, reddening or acute erosion of the cervix, mucopurulent cervical plug, copious vaginal discharge is more likely to be due to concomitant trichomonal vaginitis and lower abdominal pain and tenderness is also present, with thickening and tenderness of the affected tube on bimanual palpation. Infertility following bilateral gonococcal salpingitis is now uncommon.

To identify the problem, we look at current trend in information technology. Though the world's information technology is rapidly changing, thanks to the likes of Bill Gates and his cohorts of Microsoft Corporation and International Electronic (INTEL) of U.S.A. In developing countries like Nigeria, the case is contrary, we see a different trend in science and its development altogether. While some private and government hospitals are now computerized most especially in areas like X-Ray services, Laboratory services and Ultrasound services, the STD units, which have not been much computerized, need an urgent attention. Some of the problems inherent to the manual operation of the STD unit includes:

- Inaccurate diagnosis of the STDs, which may lead to wrong drug prescription, and at the end may lead to ultimate destruction of the organ involved, especially in women
- Bulkiness of the records because of the rate at which both the teenagers, youths and even the married go about patronising prostitutes, engaging in unprotected sex and thereby, spreading the STDs.
- Monotonous and repetitive computation.
- Retirement, transfer or even death of human expert, which when happen goes with his/her knowledge.

Viewing the above-enumerated problems, Computer-Aided Medical Diagnosis for the Treatment of gonorrhoea or STD, as the title of this project study, becomes very imperative.

1.2. Objective of the paper

Most a times, when the human expert is not available, the diagnosis and treatment of the Sexually Transmitted Disease (STD) seems to be very difficult to the infected ones. Therefore, www.astesj.com

the objective of this study is to bring together the combine knowledge of different human expertise and use it to design and implement an automated system that can aid the diagnosis of the above mentioned sexually transmitted disease and gives adequate drug prescriptions. The paper may also cover some administrative aspect for the STD patients.

2. Review of some Related Work

This paper also make reference to the works held in the field of computer application to Medicare. Recalled that [9][12][7][8][5][4][13][14], stated that "Everything must have a beginning, and that must be linked to something that went before". From the above statement, one can see that concepts are formed from the reflections of what one reads, observed, examined and discussed with others. On this note, this paper reviewed some works and studies of different writers.

Blaya [3] in his book "E-health technologies show promise in developing countries" showed how health care is noted as priority for national development strategies. Therefore, government should not depict nonchalant attitudes towards reimbursing health sector. The fact that "the largest contributor to improved health is increase wealth and that poor health is the characteristic of poverty nation", [2]. Even the call for helping hands from paramedical staff to engage themselves in most doctor's responsibilities have failed because the situation had gone beyond the resident level.

Also, the various health care system that is concerned with regulating access to financing and organising the delivery of health care to the population, [10] has failed in developing countries with criticisms arising from the field of the method of implementation adopted. It was also stated that most developing countries system, employ a radical approach which cannot go beyond the paper scope [11] but rather prevented by such problems like poverty, environmental factors, individual life styles and the lack of manpower resources. Therefore, shortage of medical expertise can be viewed as one of the most major problems affecting health care delivery services.

Very often, people in developing countries who are critically ill are rushed overseas for special treatment because it is felt that medical facilities in under developed countries are inadequate [1]. This is partly because Computer-Aided Medical Diagnosis has become a reality in many developed countries. The need to adopt an Electronic Preventive Health Care Service Approach (EPHCSA), in the field of diagnosis, treatment and record system become imperatives, to help ease the workload of a medical officer. This electronic system will help a lot in curbing the problems of STD and other dreaded health care problems.

3. Methodology

Presently in developing countries like Nigeria, human expert does the diagnosis for the treatment of STD patients manually.

This starts when a patient comes to the hospital, he either registers if he/she has not registered before or presents his/her card bearing

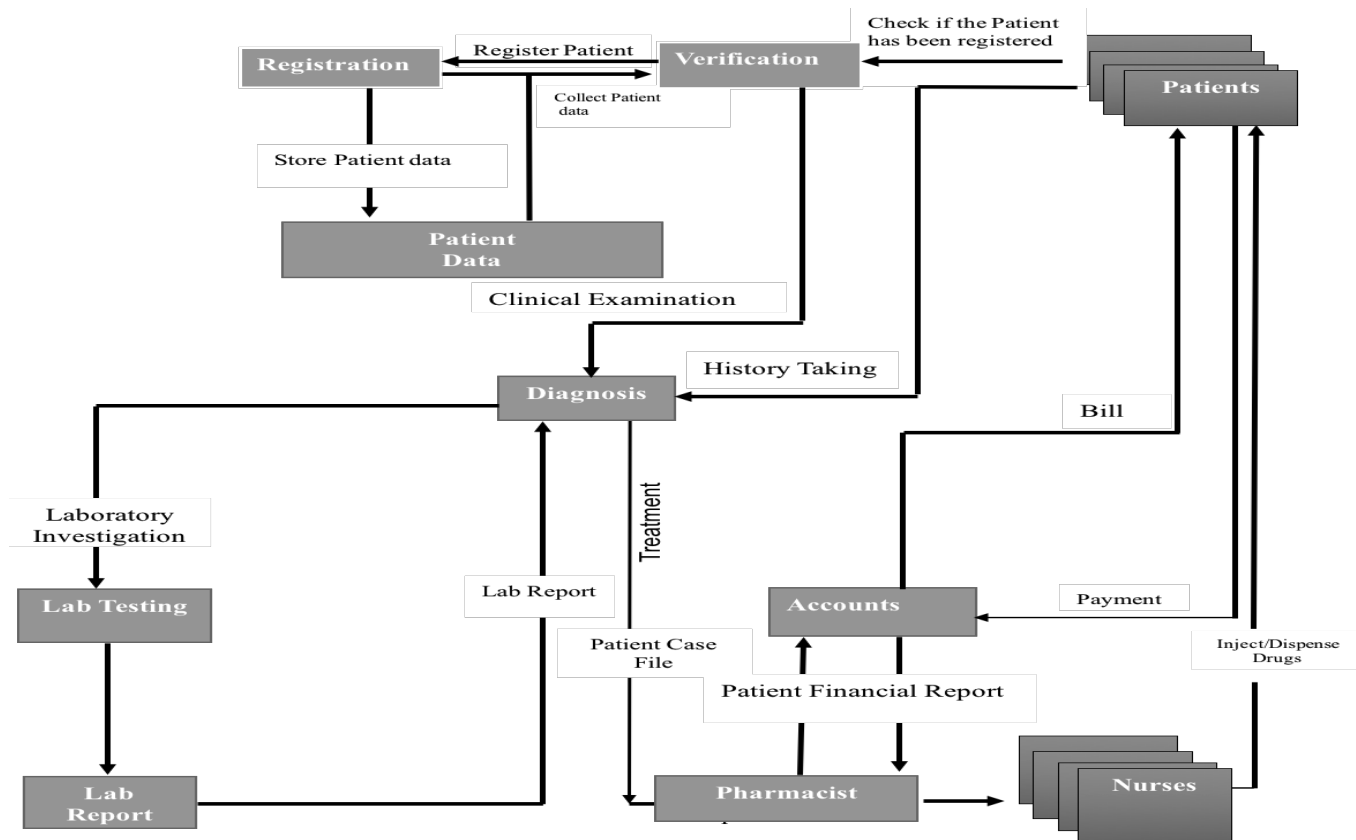


Fig. 2: Data Flow Diagram of Existing System

his/her case file. He/she then goes into doctors consulting room for some clinical examination. The doctor will now ascertain certain information from the patient about his/her illness then the patients is being diagnosed of an illness by the doctor in charge. In some cases, the doctor sends the patient for lab test if the patient has some conflicting issues. When this happens, the lab technologist will carry out the test and send the result back to the doctor, who will then prescribe drugs for the patient taking consideration on whether the patient is allergic to a certain drug or not. This process is indicated in the data flow diagram in Figure 2. The method adopted for the proposed system uses the SSADM, which is widely used in developed countries especially in the UK, a requirement for computing projects. The method sets out a series of techniques and processes, and guidelines for recording and communicating information concerning system development project both in word-based and diagrammatic form as shown in Figure 3.

Control from diagnosis and treatment shows initialization of counter, option of presence of symptoms is logical. For every selection, the counter increases to a limit, for example number of symptoms that result to gonorrhoea is six which the system identifies before giving suggestions for treatment and drugs.

These results are then save and printed out. In cases where the number of symptoms selected is not enough to term the ailment as gonorrhoea, the patient is sent for lab test and to see a medical practitioner.

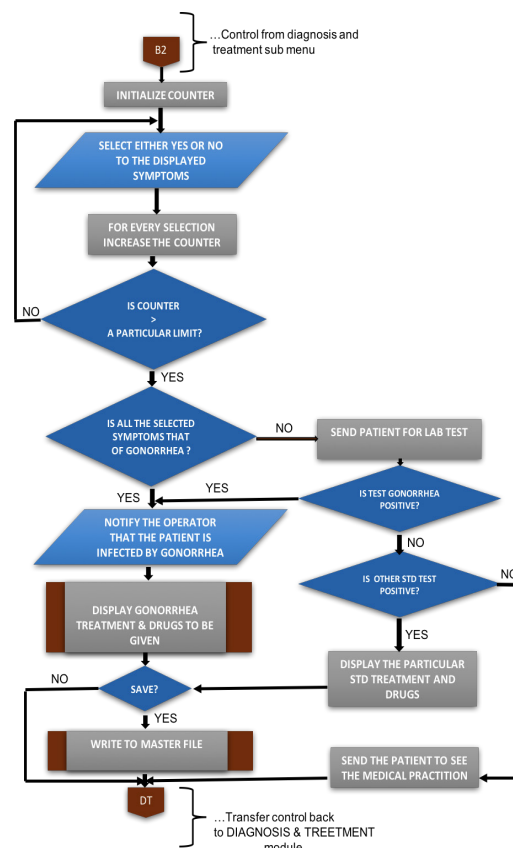


Fig. 3: Data Flow Diagram of Proposed System

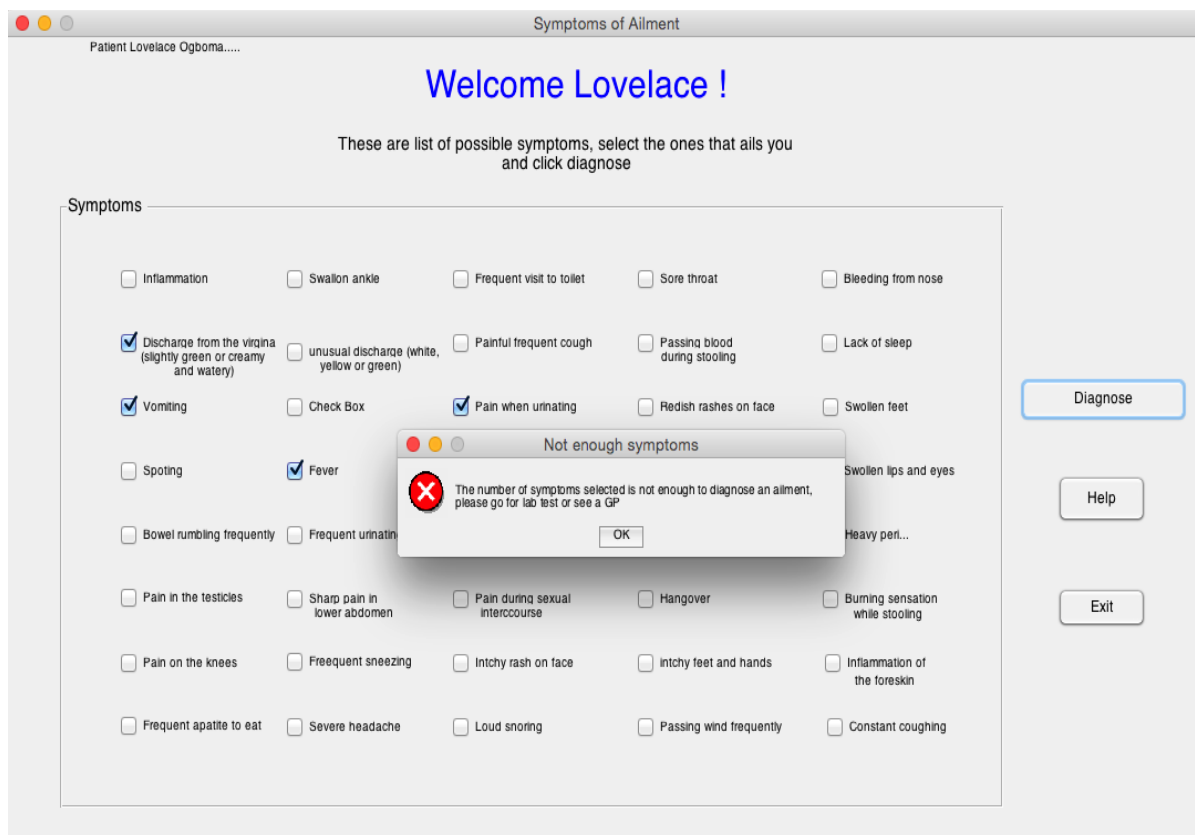


Fig. 4: Interphase with list of Symptoms for diagnosing different ailment

The patient case file will then be given to the pharmacist who will now select the drugs and give the information to the account section on how much is the cost of drugs. The account section prepares the bill for the patient, when the patient pays, the section will give a feedback to the pharmacist, who will then dispense the drugs to the patient through the nurse. In summary, the problems with existing system of diagnosis for the treatment of gonorrhoea

includes time wastage, inaccurate diagnosis sometimes poor patient case file management/retrieval and absence of human expert permanence. The merits of the proposed system include:

- reduction in time contact between patient and doctor
- permanent data source
- accurate diagnosis
- accurate patient data management
- reduction in doctor's workload
- fast diagnosis processing
- no side distraction

The primary of the proposed system is to achieve a new system which is more reliable than the old ones in terms of efficiency and service. With the introduction of a Computer Aided System the transaction is online, this allows for information to be obtained in time for maximum use. This will help the user to collect personal data of the patient, symptoms and subsequently display the drug prescription. The design took extensive use of figthe menu-driven approach which routes program of interest and ensures that the user inputs consistent access path information. The design

provides necessary manual and automated control that help to maintain the data integrity and security.

4. Analysis and Implementation

To implement the task in the proposed system, Matlab was used for its capabilities in easily integrating program modules and, possesses simbiology control tools for diagnosing biological courses. As discussed at the beginning of this paper, gonorrhoea has

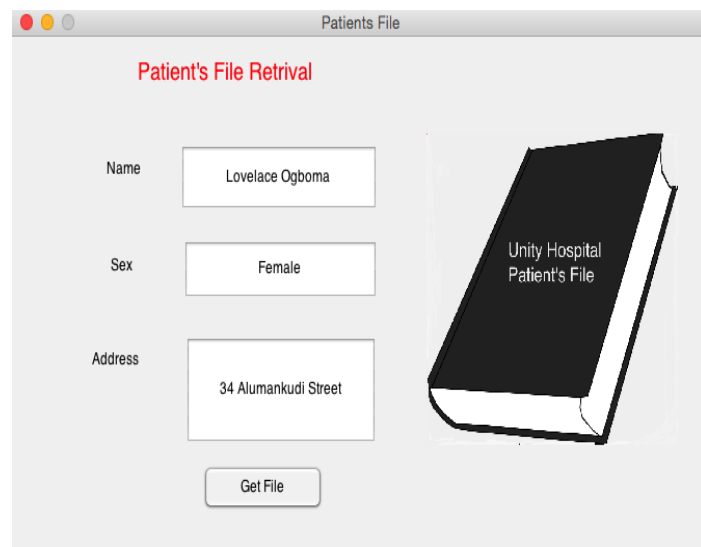


Fig. 5: Patients File Retrieval

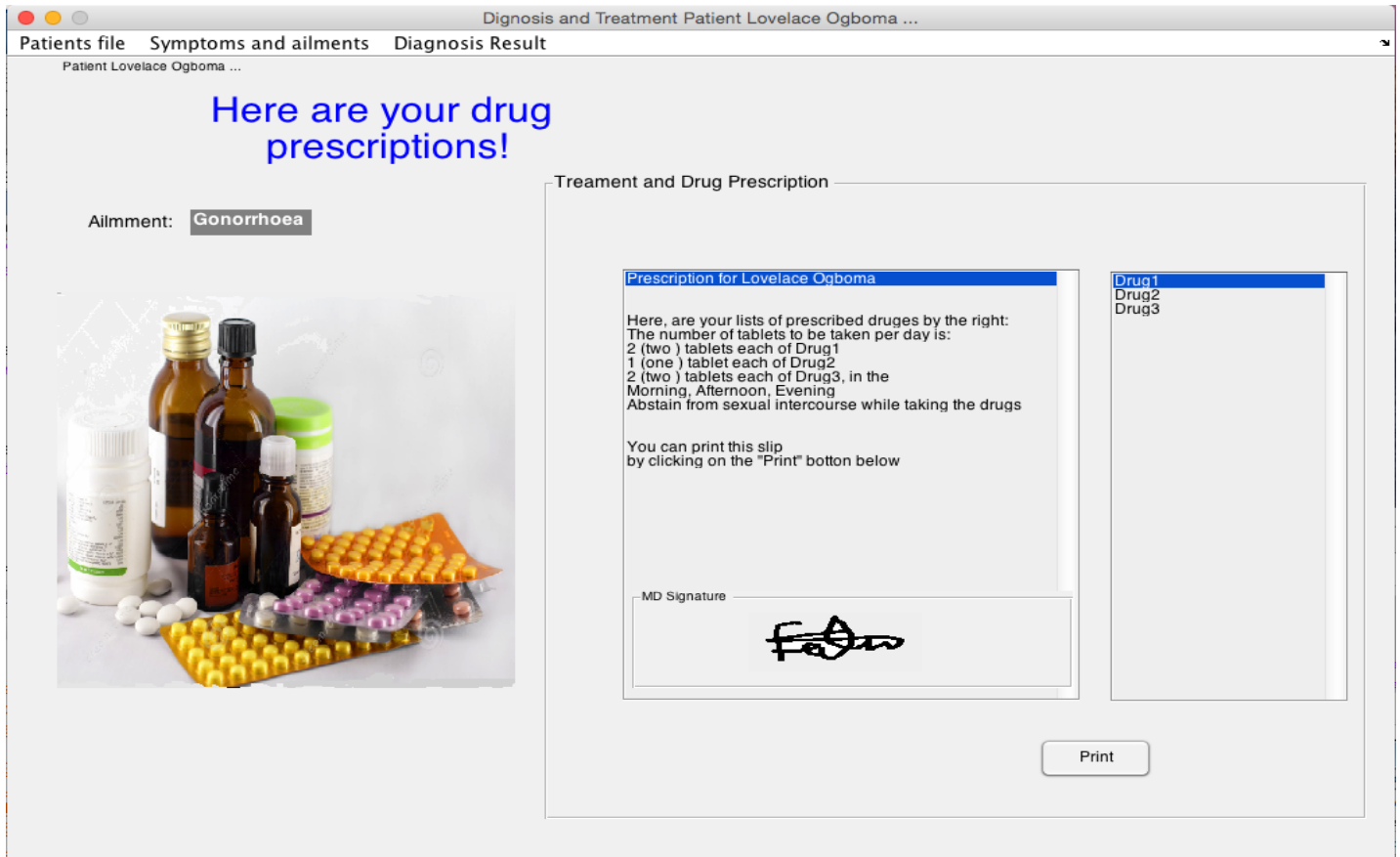


Fig. 6: Interphase displaying prescribed drugs and treatment

different symptoms for both male and female. For female, the patient could have fever, pain or a burning sensation while urinating, heavier period, discharge from the vagina that could be either creamy or slightly green in colour and watery, the frequent need to urinate, sore throat, sharp pain and the lower abdomen and finally pain upon engaging in sexual intercourse. While for male includes swelling of the foreskin, an unusual discharge from the tip of the penis, which may be the same colour has that of the female, pain or maybe tenderness in the testicles.

These number of symptoms from both parties must be entered and identified by the system (Figure 4) before a proper diagnosis can be made or else the patient may need to go for a lab test and see a practitioner. The system searches through all entries of record and selects the ones that matches the correct symptoms that is diagnosed for or recognises the ailment “gonorrhoea”, this is done through a random search and match algorithm with the Eq (1). This a simple optimization technique based on pure random search of text content. where $i = 1, \dots, n$ and limit of symptoms is equal to n . This produces the convex surface containing all possible symptoms and their corresponding ailment. The range of variables or attributes in $y(i) \sum[-m, m]m$ is the number of symptoms required to identify an ailment in the database.

```

17 SYMP = [SYMP1,SYMP2,SYMP3,SYMP4,SYMP5,SYMP6];
18 DIM = numel(SYMP);
19 SYMPSIZED = numel(DATABASE);
20 Diagtarget = char(SYMP);
21 numofiterations = 1000;
22 for j = 1:numofiterations;
23     OBJFunc = @(y) sum(y.^2);
24     ailment = 10*rand(DIM,SYMPSIZED);
25     bestsearch = min(feral(OBJFunc, ailment));
26     if bestsearch == Diagtarget;
27         break;
28     end
29 end
30 disp(ailment);
31 disp(treatment);
32 disp(drugs);

```

Fig. 7: Pure random search algorithm to identify an ailment with a given symptom

The number of symptoms selected for a patient is saved in “SYNP”, which stores selected number of symptoms identified by the system as the valid number of symptoms to fetch an ailment. The control uses a random search equivalent to methods of text mining using Matlab programming language (Figure 6 and 7)

$$g(y): g(y) = \sum y(i)^{100 \setminus 50} \dots \quad (1)$$

The search finds the best match for the ailment relating to the symptoms and produces or suggest the right treatment and drugs. The dimension of the search procedure depends on the symptoms selected. Random number of symptoms are generated to meet the target solution to an ailment matching the once in the system. The objective function equation is defined and corresponding ailments are generated randomly. The best search that relates to the given diagnosis target is then selected, if it satisfies the target ailment and the loop is broken. The right ailment is displayed together with the corresponding treatments and drugs.

5. Conclusion

The paper sort to develop a computer aided medical diagnosis for the treatment of sexually transmitted diseases such as gonorrhea. The aim and objectives of the project have been met laterality and discussed in most section of the paper. Based on the output of the interphases speed in execution, it's obvious that there would be a great relief for the doctors and even non-experts to diagnose some STDs and prescribe drugs for such diseases. Above all, computer can be the most effective and faster way in the diagnosis and treatment of sexually transmitted diseases. Despite the above, a conclusion can still be drawn by saying that STDs (gonorrhea) rate can only be reduced by avoiding sexual promiscuity, rapidly eradicating the bacteria and spirochete from infected individuals by means of early diagnosis and treatment, creating awareness through sex education. Prevention they say is better than cure, so the use of mechanical prophylaxis (condoms) and chemoprophylaxis (e.g. applying penicillin after exposure) provides only partially protection but total abstinence provides total protection. STAY HEALTHY TO BE WEALTHY. It is highly recommended that this program Computer Aided Medical Diagnosis for the Treatment of Sexually Transmitted Diseases be used in all the clinics, and most especially in an area where there is shortage of medical personnel.

Acknowledgment

The authors would like to thank the Unity Hospital in Keffi, Nassarwa state of Nigeria for taking the time to communicate the problems they are facing and making this project possible.

References

- [1] Rella Adams and Pam Duchene. Computerization of patient acuity and nursing care planning: New approach to improved patient care and cost-effective staffing. *Journal of Nursing Administration*, 15(4):11–17, 1985.
- [2] Word Bank. Review of banks activities in the health sector in europe and central asia. 1990.
- [3] Joaquin A Blaya, Hamish SF Fraser, and Brian Holt. E-health technologies show promise in developing countries. *Health Affairs*, 29(2):244–251, 2010.
- [4] David Dean, Kyoung-June Min, and Angus Bond. Computer aided design of large-format prefabricated cranial plates. *Journal of Craniofacial Surgery*, 14(6):819–832, 2003.
- [5] Robert Feyen, Yili Liu, Don Chaffin, Glenn Jimmerson, and Brad Joseph. Computer-aided ergonomics: a case study of incorporating ergonomics analyses into workplace design. *Applied ergonomics*, 31(3):291–300, 2000.

- [6] Richard Harvey, S. Y Salih, and Alan E Read. Organic and functional disorders in 2000 gastroenterology outpatients. *The Lancet*, 321(8325):632–634, 1983.
- [7] R Hillyard and Ie Braid. Analysis of dimensions and tolerances in computer-aided mechanical design. *Computer Aided Design*, 10(3):161–166, 1978.
- [8] William L Jorgensen, Juliana Ruiz-Caro, Julian Tirado-Rives, Aravind Basavapathruni, Karen S Anderson, and Andrew D Hamilton. Computer-aided design of non-nucleoside inhibitors of hiv-1 reverse transcriptase. *Bioorganic & medicinal chemistry letters*, 16(3):663–667, 2006.
- [9] George F Luger and William A. Stubblefield. *Artificial intelligence and the design of expert systems*, benjemmin, 1989.
- [10] Michael Moran. Three faces of the health care state. *Journal of Health Politics, Policy and Law*, 20(3):767–781, 1995.
- [11] Cliff Moughtin, Paola Signoretta, and Kate McMahon Moughtin. *Urban design: health and the therapeutic environment*. Routledge, 2009.
- [12] Nelishia Pillay. A generative hyper-heuristic for deriving heuristics for classical artificial intelligence problems. In *Advances in Nature and Biologically Inspired Computing*, pages 337–346. Springer, 2016.
- [13] Jose Reina, Emmanuel Lacroix, Scott D Hobson, Gregorio Fernandez-Ballester, Vladimir Rybin, Markus S Schwab, Luis Serrano, and Cayetano Gonzalez. Computer-aided design of a pdz domain to recognize new target sequences. *Nature Structural & Molecular Biology*, 9(8):621–627, 2002.
- [14] Anne Verroust, Francois Schonek, and Dieter Roller. Rule-oriented method for parameterized computer-aided design. *Computer-Aided Design*, 24(10):531–540, 1992.

Pseudo-Analysis: measures of general conditional information

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ARTICLE INFO

Article history:

Received: 28 December, 2016

Accepted: 06 February, 2017

Online: 25 February, 2017

Keywords:

General information

Conditional information

Pseudo-operations

Independent property

Functional equations

ABSTRACT

The aim of this paper is to continue our study of information in the setting of Pseudo-Analysis. We shall present, by axiomatic way, the definition of measures of general conditional information and we shall study particular measure by using a system of functional equations in which it is present a pseudo-operation. We know that J.Aczel is the founder of the Theory of Functional Equations and he solved the so called "Cauchy Equation". The method used in this paper consists in reducing the principal equation, to some basic known equations solved by Aczel and his school. With Benvenuti we studied a generalization of the Cauchy Equation and following these our results, we are able to give the general solution of the system and the expression for this measure of general conditional information.

1 Introduction

Since 1967 Kampé De Fériét and Forte introduced, by axiomatic way, the definition of *measures J for general information*, where *general* means that *J* is defined without probability [1].

Later, in [2], we introduced some particular family of crisp set $(\mathcal{N}, \mathcal{F}, \mathcal{I}_\infty, \mathcal{I}_0)$, in order to study the integration in information theory without probability. We have used them for the definition of measures of general conditional information [3].

In this paper, we would continue the researches in the setting of Pseudo-Analysis, started in [4], by using *pseudo-addition* and *pseudo-difference*. In particular we shall study measures for general conditional information for crisp sets.

The properties of the form of conditional information have translated in a system of functional equations [5], for which we shall give a class of solutions.

Moreover, by using the property of *J*-independence we obtain another equation: we shall find the general solution through our previous result [6].

The paper is organize in the following way: in Sect.2 we recall some preliminaries; in Sect.3 we give the definition of general information conditioned by a variable event in pseudo-analysis. In Sect.4 we con-

sider the statement of the problem and we translate the properties of the form of conditional information in a system of functional equations.

We shall distinguish two cases: general case and independent case. In this last case the definition of independence is given by using the pseudo-analysis. We shall show some classes of solutions in Sect. 5. Sect.6 is devoted to the conclusions.

2 Preliminary notations

2.1 Pseudo-operations

We follow the Theory of Pseudo-Analysis introduced by E.Pap and his colleague [7], which consider the definition of pseudo operations. In particular, we shall use the pseudo-addition \oplus and the pseudo-difference \ominus : for knowledge about these pseudo-operations, we refer to [8].

Definition 2.1 The pseudo-addition \oplus is a binary function

$$\oplus : [0, M]^2 \longrightarrow [0, M], \quad M \in (0, +\infty),$$

which is commutative, associative, strictly increasing with respect \leq , with 0 as neutral element.

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We shall consider only particular operation \oplus expressed by a function g , called *generator function* in the following way:

$$u \oplus_g v = g^{-1}(g(u) + g(v)), \quad (1)$$

where $g : [0, M] \rightarrow [0, +\infty]$ and it is bijective, continuous and strictly increasing with $g(0) = 0$ and $g(+\infty) = +\infty$.

Definition 2.2 The pseudo-difference \ominus is a mapping,

$$\ominus : [0, M]^2 \rightarrow [0, M], \quad M \in (0, +\infty],$$

which we shall define through the same function g :

$$u \ominus_g v = g^{-1}(g(u) - g(v)), \quad u \geq v. \quad (2)$$

2.2 Measures of general information in classical analysis

Following [1], let X be an abstract space and \mathcal{A} a σ -algebra of all subsets of X , such that (X, \mathcal{A}) is a measurable space.

Definition 2.3 Measure of the general information is a mapping

$$J(\cdot) : \mathcal{A} \rightarrow [0, +\infty]$$

such that $\forall A_1, A_2 \in \mathcal{A}$:

- (2.3.1) $A_1 \supset A_2 \Rightarrow J(A_1) \leq J(A_2)$,
- (2.3.2) $J(\emptyset) = +\infty$, $J(X) = 0$.

Moreover, we have the following [1]:

Definition 2.4 Given a subfamily $\mathcal{K} \subset \mathcal{A}$, two sets $K, K' \in \mathcal{K}, K \neq K', K \cap K' \neq \emptyset$ are called *J-independent* (i.e. independent with respect to J) if the couple (K, K') satisfies the following:

$$J(K \cap K') = J(K) + J(K'). \quad (3)$$

From [2], assigned an information measure J , we have considered the family:

$$\mathcal{I}_{+\infty} = \{F \in \mathcal{A} / J(F) = +\infty\}. \quad (4)$$

The family (4) is not empty because it contains the empty set \emptyset and all subsets F' of $F \in \mathcal{I}_{+\infty}$:

$$F \in \mathcal{I}_{+\infty}, J(F) = +\infty, \forall F' \in \mathcal{A}, F' \subset F, J(F) \geq J(F') = +\infty \Rightarrow F' \in \mathcal{I}_{+\infty}.$$

$\mathcal{I}_{+\infty}$ is not an filter [9] because it is not stable with respect to the intersection between fuzzy sets.

Given the family $\mathcal{H} = \mathcal{A} - \mathcal{I}_{+\infty}$ we recall from [3],

Definition 2.5 The measure of general conditional information of any set $A \in \mathcal{A}$ conditioned by a fixed $H \in \mathcal{H}$, $(J(A|H))$ is a mapping

$$J(\cdot|H) : \mathcal{A} \rightarrow [0, +\infty]$$

such that

- (2.5.1) $A' \supset A \Rightarrow J(A'|H) \leq J(A|H), \quad \forall A, A' \in \mathcal{A}$,

- (2.5.2) $J(\emptyset|H) = +\infty$,

- (2.5.3) $J(X|H) = 0$.

Moreover, from [2], we have the following:

Definition 2.6 Given a subfamily $\mathcal{K} \subset \mathcal{A}$, two sets $K, K' \in \mathcal{K}, K \neq K', K \cap K' \neq \emptyset$ are called *J-conditional independent* (i.e. conditioned by a fixed event $H \in \mathcal{H}$ if the couple (K, K') satisfies the following condition:

$$J((K \cap K')|H) = J(K|H) + J(K'|H). \quad (5)$$

3 Pseudo-analysis: measures of general conditional information

In [4], for the first time, we have introduced the definition of *J- independence* property in the setting of pseudo-analysis, and we have used it to find the information of the union of two sets $A, A' \in \mathcal{A} : J(A \cup A')$. From now on we consider a pseudo-addition \oplus_g generated by a function g as in (1).

Definition 3.1 Given a subfamily $\mathcal{K} \subset \mathcal{A}$, and a pseudo-addition \oplus_g , two sets $K, K' \in \mathcal{K}$, are called *J-independent in pseudo-analysis* if the couple (K, K') satisfies the following:

$$J(K \cap K') = J(K) \oplus_g J(K'), \quad K \neq K', K \cap K' \neq \emptyset. \quad (6)$$

In pseudo-analysis, for the general conditional information, we shall replace the common addition in (3) with the pseudo-addition \oplus_g , so we shall propose the following:

Definition 3.2 Given a subfamily $\mathcal{K} \subset \mathcal{A}$, two sets $K, K' \in \mathcal{K}$ are called *J- conditional independent in pseudo-analysis* if the couple (K, K') satisfies the following property:

$$J((K \cap K')|H) = J(K|H) \oplus_g J(K'|H), \quad (7)$$

$$K \neq K', K \cap K' \neq \emptyset.$$

In [10] we have generalize the property of *J-independence*.

4 Statment of the problem: the function Φ

In this paragraph, fixed an information J , we would look for the measure of general conditional information of any set $A \in \mathcal{A}$ conditioned by a fixed $H \in \mathcal{H}$,

$$J^*(A|H)$$

as a function Φ which depends only on $J(A \cap H)$ and $J(H)$. We suppose that the function Φ is continuous

$$\Phi : T \rightarrow (0, +\infty],$$

where $T = \{(x, y) / x, y \in [0, +\infty], x \geq y : \exists A \in \mathcal{A}, H \in \mathcal{H}, x = J(A \cap H), y = J(H)\}$ and

$$J^*(A|H) = \Phi(J(A \cap H), J(H)). \quad (8)$$

4.1 General case

The conditions (2.5.1)-(2.5.3) become:

$$\left\{ \begin{array}{l} \text{(E1)} \quad \Phi(J(A' \cap H), J(H)) \leq \Phi(J(A \cap H), J(H)), \\ \quad \forall A, A' \in \mathcal{A}, A' \supset A, \\ \text{(E2)} \quad \Phi(J(\emptyset), J(H)) = +\infty, \\ \text{(E3)} \quad \Phi(J(H), J(H)) = 0. \end{array} \right.$$

Setting $J(A \cap H) = x, J(A' \cap H) = x', J(H) = y, x, x', y \in [0, +\infty], x' \geq y, x \geq y$ the equations (E1) – (E3) get the following form:

$$\left\{ \begin{array}{l} \text{(e1)} \quad \Phi(x', y) \leq \Phi(x, y), \quad x' \leq x, x' \geq y, x \geq y, \\ \text{(e2)} \quad \Phi(+\infty, y) = +\infty, \\ \text{(e3)} \quad \Phi(y, y) = 0. \end{array} \right.$$

4.2 Independent case

In this paragraph, we shall consider J - independent sets in pseudo-analysis.

We suppose that there exist two sets $K, K' \in \mathcal{K}, K \neq K', K \cap K' \neq \emptyset$, which are J - independent in pseudo-analysis in the sense of (6). From (7), and taking into account (8), it is

$$\begin{aligned} J^*((K \cap K')|H) &= \Phi(J(K \cap K') \cap H, J(H)) = \quad (9) \\ &= \Phi(J(K \cap H \cap K' \cap H), J(H)) = \\ &= \Phi(J(K \cap H) \oplus_g J(K' \cap H), J(H)), \end{aligned}$$

On the other hand, by (8),

$$\begin{aligned} J^*(K|H) &= \Phi(J(K \cap H), J(H)), \quad (10) \\ J^*(K'|H) &= \Phi(J(K' \cap H), J(H)), \end{aligned}$$

Then, we obtain the condition of J -independence in pseudo-analysis:

$$\Phi(J(K \cap H) \oplus_g J(K' \cap H), J(H)) = \quad (11)$$

$$\Phi(J(K \cap H), J(H)) \oplus_g \Phi(J(K' \cap H), J(H)),$$

$$K, K' \in \mathcal{K}, K \neq K', K \cap K' \neq \emptyset.$$

Setting $J(K \cap H) = t, J(K' \cap H) = t', t, t' \in [0, +\infty], t \neq t', t \geq y, t' \geq y$ with $J(H) = y$, the (10) becomes

$$\begin{aligned} \text{(e4)} \quad \Phi(t \oplus_g t', y) &= \Phi(t, y) \oplus_g \Phi(t', y), \quad t, t' \in [0, +\infty], \\ &t \neq t', t \geq y, t' \geq y. \end{aligned}$$

5 Solutions of the problem

Now, we are giving some solutions of the problem, distinguishing two previous cases.

5.1 General case

Proposition 5.1 A class of continuous solutions of the system (e1) – (e3) is

$$\Phi_\rho(x, y) = \rho^{-1}(\rho(x) \oplus_g \rho(y)), \quad (12)$$

where $\rho : [0, +\infty] \rightarrow [0, +\infty]$ is any bijective, continuous, strictly increasing function, with $\rho(0) = 0, \rho(+\infty) = +\infty$ and \oplus is defined in (2).

Proof. The condition (e1) is satisfied as the composition of two increasing functions ρ and g . The conditions (e2) and (e3) are verified by the values $g(0) = \rho(0) = 0$ and $\rho(+\infty) = g(+\infty) = +\infty$. Moreover ρ is continuous as the generator function g . \square

Proposition 5.2 Another class of continuous solutions of the system (e1) – (e3) is

$$\Phi_\mu(x, y) = x \ominus_\mu y, \quad \mu = g \cdot m \quad (13)$$

where μ is the product of the generator function g of the operation \ominus_g given by (2) and m is any function as in (12).

Proof. Let m be a particular function solution of the system (e1) – (e3) as in Prop.[5.1], which defines a pseudo-addition \oplus_m . From (2) and (10), it is

$$\Phi_m(x, y) = m^{-1}(m(x) \oplus_g m(y)) = \quad (14)$$

$$= m^{-1}\left\{g^{-1}\left((g(m(x)) + (g(m(y))))\right)\right\} =$$

$$= \mu^{-1}(\mu(x) + \mu(y)) = x \ominus_\mu y,$$

$$\text{where } \mu = g \cdot m \iff \mu^{-1} = m^{-1} \cdot g^{-1}$$

By the properties of g and m the solutions are continuous. \square

Any function ρ in Prop.[5.1], in general, doesn't define a pseudo-addition of the kind \oplus_g as in (1) because it is not commutative, neither associative. For this reason the Prop.[5.2] is not a consequence of Prop.[5.1].

5.2 Independent case

Now, we rewrite the equation (e4):

$$(e4) \quad \Phi(t \oplus_g t', y) = \Phi(t, y) \oplus_g \Phi(t', y),$$

$$t, t' \in [0, +\infty], t \neq t', t \geq y, t' \geq y.$$

Fixed $y = y^*$, the condition (e4) is

$$\Phi(t \oplus_g t', y^*) = \Phi(t, y^*) \oplus_g \Phi(t', y^*), \quad (15)$$

setting

$$\Phi(t, y^*) = \Psi(t), \quad (16)$$

the equation (15) becomes

$$\Psi(t \oplus_g t') = \Psi(t) \oplus_g \Psi(t'). \quad (17)$$

The equation (17) is a particular case of a general Cauchy equation

$$F(x \oplus y) = F(x) \oplus F(y),$$

on suitable hypothesis on the function F , when \oplus is any pseudo-addition not necessary expressed by a generator function g . The equation (17) has been solved by Benvenuti and the authors in [6] in many general cases.

In particular, when this pseudo-addition is generated by function g , we found all continuous solutions. Here, we neglect trivial solutions and we consider only the most meaningful solution. We recall the result from [6]:

Theorem 5.3 *The solution of the general Cauchy equation*

$$F(x \oplus_g y) = F(x) \oplus_g F(y), \quad (18)$$

under suitable hypothesis on F , when the operation \oplus_g is defined by a generator function g

$$u \oplus_g v = g^{-1}(g(u) + g(v))$$

is (really, we should say of a class of solution depending on a parameter λ) the following continuous function

$$F_\lambda(x) = g^{-1}(\lambda \cdot g(x)), \quad \lambda \in (0, +\infty), \quad (19)$$

with g the generator function of the pseudo-addition (2).

□

By using the previous result, the class of solution of (16) is

$$\Psi(t) = g^{-1}(\lambda \cdot g(t)), \quad \lambda \in (0, +\infty), \quad (20)$$

with g the generator function of the pseudo-addition (2).

Now, we can go back to our original problem concerning the J -independence property in pseudo-analysis and we are ready to give the **main theorem**.

Let \mathcal{L} be any family of continuous function $\Lambda : (0, +\infty) \rightarrow (0, +\infty)$:

$$\mathcal{L} = \{\Lambda : (0, +\infty) \rightarrow (0, +\infty), \text{continuous}\}. \quad (21)$$

Theorem 5.4 *The class of continuous solutions of the equation*

$$(e4) \quad \Phi(t \oplus_g t', y) = \Phi(t, y) \oplus_g \Phi(t', y),$$

$$t, t' \in [0, +\infty], t \neq t', t \geq y, t' \geq y$$

is the family, depending on any element $\lambda(y)$ of \mathcal{L} ,

$$\Phi_{\Lambda(y)}(t) = g^{-1}(\Lambda(y) \cdot g(t)). \quad (22)$$

Proof. Now, fixed any function $\Lambda(y) \in \mathcal{L}$, we are verifying that (22) is solution of (e4):

$$\begin{aligned} \Phi(t \oplus_g t', y) &= \Phi_{\Lambda(y)}(t \oplus t') = g^{-1}(\Lambda(y) \cdot g(t \oplus t')) = \\ &= g^{-1}(\Lambda(y) \cdot g\{g^{-1}[g(t) + g(t')]\}) = \\ &= g^{-1}(\Lambda(y) \cdot [g(t) + g(t')]) = \\ &= g^{-1}(\Lambda(y) \cdot g(t) + \Lambda(y) \cdot g(t')) = \\ &= g^{-1}(gg^{-1}[\Lambda(y) \cdot g(t)] + gg^{-1}[\Lambda(y) \cdot g(t')]) = \\ &= g^{-1}(g\{g^{-1}[\Lambda(y) \cdot g(t)]\} + g\{g^{-1}[\Lambda(y) \cdot g(t')]\}) = \\ &= g^{-1}(g\{\Phi_{\Lambda(y)} \cdot g(t)\} + g\{\Phi_{\Lambda(y)} \cdot g(t')\}) = \\ &= (\Phi_{\Lambda(y)}(t)) \oplus_g (\Phi_{\Lambda(y)}(t')) = \Phi(t, y) \oplus_g \Phi(t', y). \end{aligned}$$

It is easy to see that any function (22) is continuous. □

Proposition 5.5 *The function $\Phi_{\Lambda(y)}(t)$ given by (22) is strictly increasing with respect to the variable t .*

Proof. The monotonicity of the function $\Phi_{\Lambda(y)}(t)$ doesn't depend on the variable y ; moreover $\Lambda(y)$ is positive. Then,

$$\forall t \leq t^* \text{ and } \forall \Lambda(y) \in \mathcal{L}, \Phi_{\Lambda(y)}(t) \leq \Phi_{\Lambda(y)}(t').$$

□

As consequence of Theorem [5.4] and of Proposition [5.5], we get the following

Theorem 5.6 *The only solution of the equations*

$$(e1) \quad \Phi(x', y) \leq \Phi(x, y) \quad x' \leq x, x' \geq y, x \geq y$$

$$(e4) \quad \Phi(t \oplus_g t', y) = \Phi(t, y) \oplus_g \Phi(t', y),$$

$$t, t' \in [0, +\infty], t \neq t', t \geq y, t' \geq y.$$

is the family, depending on any element of \mathcal{L} , given by (21),

$$\Phi_{\Lambda(y)}(t) = g^{-1}(\Lambda(y) \cdot g(t)). \quad (23)$$

□

It is easy to see that the conditions (e2) and (e3) are not compatible with the independent property.

6 Conclusion

In this paper, given a measure of general information J , we have defined the measure of general conditional information $J^*(A|H)$ of any set $A \in \mathcal{A}$ conditioned to $H \in \mathcal{H}$.

Moreover, we have considered $J^*(A|H)$ depending only on $J(A \cap H)$ and $J(H)$ through a function Φ . The properties of this $J^*(A|H)$ are translated in a system of functional equations.

In order to look for solutions of the system, we distinguish two cases: the first concerning monotonicity and particular values of $J^*(A|H)$, system (e1)-(e3), the second one related to monotonicity and independence property, equations (e1) and (e4).

I-General case: system (e1)-(e3)

Some classes of the measure of general conditional information are: from (12)

$$J_{\rho}^*(A|H) = \rho^{-1} \left(\rho \left(J(A \cap H) \right) \ominus_g \rho \left(J(H) \right) \right),$$

where $\rho : [0, +\infty] \rightarrow [0, +\infty]$ is any bijective, continuous, strictly increasing function, with $\rho(0) = 0$, $\rho(+\infty) = +\infty$ and from (13)

$$J_{\mu}^*(A|H) = J(A \cap H) \ominus_{\mu} J(H),$$

where μ is the product of the generator function g of the operation \ominus_g given by (2) and m is any function as in (1).

II-Independent case: equations (e1) and (e4)

From (23) one and only one class of solutions is:

$$J^*(A|H) = g^{-1} \left(\Lambda \left(J(H) \right) \cdot g \left(J(A \cap H) \right) \right),$$

depending on a class of functions $\Lambda \in \mathcal{L}$, where $\in \mathcal{L}$ is defined in (21).

Conflict of Interest The authors declare no conflict of interest.

Acknowledgment This research is in the framework of GNFM (Gruppo Nazionale per la Fisica Matematica) del MIUR (Ministero Italiano per l'Università e la Ricerca), ITALY.

References

1. J.Kampe De Feriet, B.Forte, "Information et Probabilite applications" Compt.Rand.Ac.Sc.Paris, **265**, 110-114, 142-146, 350-353, 1967.
2. D.Vivona, "Information Theory and Fuzzy Integrals: along the way paved by Pietro Benvenuti, 10th International Conference on Information Processing and Management of Uncertainty in Knowledge-based System (IPMU), Perugia Italy, 2004.
3. D.Vivona - M.Divari, "On a conditional information for fuzzy sets, International Summer School on Aggregation Operators and their applications (AGOP), Lugano Switzerland, 2005.
4. D.Vivona - M.Divari, "Pseudo-Analysis: some measures of general information, IEEE 14th International Symposium on Intelligent Systems and Informatics (SISY), Subotica Serbia, 2016.
5. J. Aczel, "Lectures on functional equations and their applications, New York, Academic Press, 1966.
6. P.Benvenuti - R.Mesiar - D.Vivona, "The cauchy equation on I-semigroup, Aequ.Math. **63**, 2002.
7. E. Pap, "Null-additive Set Functions Dordrecht. Kluwer Academic Publishers, 1995.
8. P.Benvenuti - R.Mesiar - D.Vivona, "Monotone set-functions-based integrals, Handbook in Measure Theory, Elsevier Ed. 2002.
9. K.Yosida, "Functional analysis, Springer, 1995.
10. D.Vivona - M.Divari, "An Independence property for General Information, Natural Sciences **8** 2016, dx.doi.org/10.4236/ns.2016.82008.