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EVALUATION OF PATIENTS' SATISFACTION TREATED WITH DENTAL BRIDGES IN ALKHOUMS CITY

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Abstract

The aim of the present study were to evaluate of patients' satisfaction treated with dental bridges at 15 private dental clinics in Alkhoms city during the period from July 2018 to June 2019. The patients were contacted via telephone for a structured interview using a previously validated patient satisfaction questionnaire covering the different aspect of satisfaction of dental bridges therapy. Descriptive statistics was used to describe the basic features of the data in the present study and Chi-square test was applied at a significant level of $P<0.05$. A total of 208 patients treated with dental bridges were contacted by telephone. One hundred eighty two patients responded, of them 146 (39 male and 107 female) agreed to participate in the present study. The difference between genders in related to participant in the present study was significant ($P<0.05$). The majority of overall patients 80.14% were satisfied with their dental bridges and more than three quarters of both patients (female and male) were satisfied 77.57% and 87.18% respectively. The male were more satisfied than female from the treatment but no significant difference $P>0.05$. As for some aspect of dental bridge, about 86% of patients were satisfied with the aesthetics of their dental bridges at the time of interview. In relation to phonetics about 90% of patients were satisfied by their speech. As well, there were about 81% of patients were satisfied with the masticatory function, while only about 38% of patients were satisfied with the cost of dental bridges made.

Introduction

Missing teeth is one of the common problems seen in dental clinics (Radzi et al., 2018). Tooth loss can have negative impacts on facial appearance, speech, and mastication. The main causes of the tooth loss may be either dental caries or periodontal disease (Lin et al., 2001). Dental caries is considered the major cause of tooth loss in younger adult, while periodontal disease which cause tooth loss over age 40 years (Hayashi et al., 2001). A fixed prosthesis is defined as any dental prosthesis that is luted, screwed or mechanically attached or otherwise securely retained to natural teeth, tooth roots and or dental implant abutments (Smith et al., 2016). Dental bridges as known fixed partial denture (FPD) are one of fixed prosthesis which serves to restore the function and aesthetics of badly broken down teeth and in some instances to replace missing teeth. FPD is characterized as a partial denture that is established to regular teeth or roots which outfit essential help to the prosthesis. FPD is indicated in short span edentulous arches, presence of sound teeth that can offer adequate help nearby the edentulous space [8]. It is likewise demonstrated for rationally bargained and physically challenged patients who can't keep up removable prosthesis.

Patients can be deprived socially by tooth loss and majority of patients undergoing prosthetic rehabilitation in their study were distressed emotionally after having tooth loss (Davis et al., 2000). The major concern of the dentists performing dental rehabilitation is the improvement of the aesthetic and functional ability of the patients along with the elimination of masticatory and other oral problems (Mohammed et al., 2017). Patients seek dental treatment with aim of rehabilitation and improvement of oral health and functions. At the same time, dental treatment also aims for the complete patient satisfaction (Petricevic et al., 2012). The success of any treatment depends upon factors such as function, esthetics, and masticatory ability. Conventional crowns and bridgeworks make up a major element of general and prosthodontic dental practice, especially in developing countries (Tan et al., 2004). The restorative material may be all metal, all porcelain, a metal-ceramic combination, or a metal with processed resin. The replacement of missing teeth by appropriately designed prostheses is in demand, and is required to maintain a good health status and normal life (Ellis et al., 2007). Patients evaluate their prosthesis in form of personal satisfaction. Comfort, stability and design of dentures are the main factors which provide satisfaction to the patients (Mohammed, 2009). Patients' dissatisfaction with dental prosthesis associated with ability to chewing and speaking, as well as, some of main disadvantages of dental prosthesis such as risk to local damage of the remaining teeth, plaque accumulation, have a great impact on the patient satisfaction with their prosthesis.

The dental literature has some several articles on the topic of fixed partial dentures (Geiballa et al., 2016). However, only a few number of them deal with level of satisfaction with fixed partial dentures treatment. Studies to investigate patient's satisfaction were carried out in different countries, including Sudan (Geiballa et al., 2016), India (Chezhian, 2016), Kingdom of Saudi Arabia (Mohammed et al., 2017) all concluded that patient's satisfaction with FPD was very high.

Up to date, subjective satisfaction of patients treated with dental bridges in Alkhoms city has not been evaluated. Thus, the present study aimed to evaluate s satisfaction of patients treated with dental bridges.

MATERIAL AND METHODS

The present study was carried out at 15 private dental clinics in Alkhoms city. It comprised of all patients of both genders treated with dental bridge during period of July 2018 to June 2019. All participants informed regarding the present study and consent was obtained after explaining in detail the entire study protocol. Confidentiality of all information given was guaranteed. Previously validated patient satisfaction questionnaires (Amel et al., 2016; Singh, 2017) were used, each participant was asked to answer a satisfaction questionnaire regarding aspects of esthetics, speech, masticatory function, cost, and general satisfaction. General information such as age and gender were recorded. Data collection was conducted between the hours of 9:30 AM and 6:00 PM, as such, patient diversity was thus reduced to those who had active phone numbers, who were able to answer the phone and were available for 10 minutes to go through the interview process during these times.

Statistical Analysis

The patient interview data were organized and analyzed using (SPSS) version 20 for Windows (SPSS Inc., Chicago, Illinois, USA) and MS Excel (Microsoft Office, Windows 2010, USA). Chi-square test was used to find out the differences in satisfaction between the groups. Furthermore, the confidence interval for proportion with significance level 95%.

RESULTS & DISCUSSION:

In the present study, 208 patients who had received dental bridge from 15 private dental clinics in Alkhoms city during period of July

2018 to June 2019 were contacted by telephone. One hundred eighty two patients responded, and One hundred forty six of them (39 male and 107 female) agreed to participate in the present study (Table 1). The difference between male and female was significant (P<0.05). In general, the response rate was 70.19%. Aljabri et al. (Aljabri et al., 2017) reported in their Saudi phone interview survey a lower response rate of 11%. Thus, according to Kashbur and Bugaighis (Kashbur & Bugaighis, 2019) this ratio is considered reasonable. The participant's percentage of female in the present study was about three-quarters the number of participants. Similar sex difference was observed in comparable studies (Kashbur & Bugaighis, 2019; Tin-Oo et al., 2011). This finding may be attributed to in which female more critical about their dentofacial appearance than male. According to (Geiballa et al., 2016) One reason for the greater number of female participants might be that usually, females are more conscious about their appearance and might be more interested in restoring their teeth compared to males.

Table 1: Gender distribution of patients

Variable	Categories	Frequency	Percentage %	P value
Gender	Male	39	26.71	.000
	Female	107	73.29	
	Total	146	100	

Figure 1 shows age distribution of patients. The age of the patients ranged from 18 to 80 years, and the mean age was 31.5 years. 9.59% of which were below 30 years and 30.82% ranging from 31 to 40 years of age. Majority of the patients 42.47% belonged to the age-group of 41 to 50 years. 13.01% belonged to the age group of 51 to 60 years. Only six patients 4.11% belonged to the age group of 61 to 80 years.

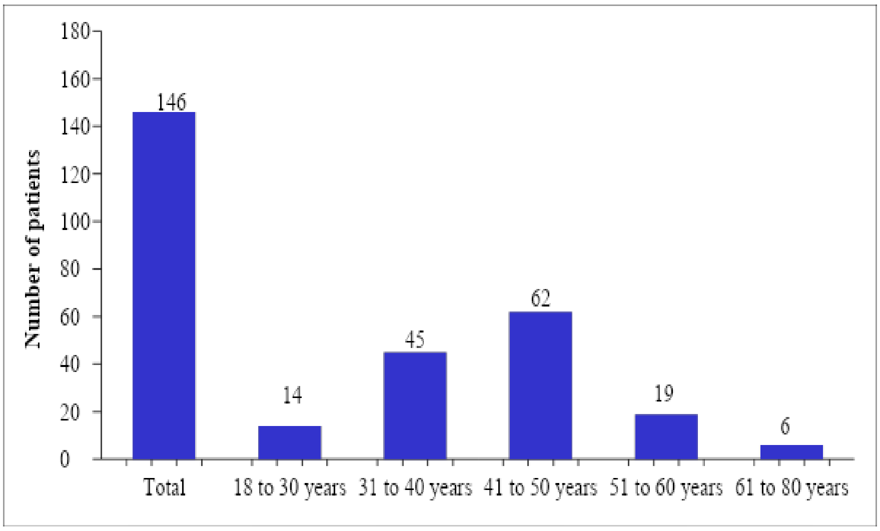

Figure 1: Age distribution of patients.

Figure 2 shows the level of patient satisfaction in general, the majority of overall patients about 80.14% were satisfied with their dental bridges while <1 quarter of patients 19.86% were dissatisfied at the time of interview. This similar level of patient satisfaction with their fixed prosthesis was described in a number of other studies (Siqueira et al., 2013; Smith et al., 2016; Zlataric & Celebic, 2008). This high satisfaction level could be attributed to the fact that fixed restorative treatment might had restored the feeling of "normality" to the patient, as he/she felt the prosthesis more like a natural tooth. Al-Quran et al. (Al-Quran et al., 2011) who assessed patient satisfaction with several treatment options and the factors that would affect the treatment decision to replace a single missing tooth. They observed that patients who were using removable prosthesis preferred their FPDs. Moreover, (Geiballa et al., 2016) assessed the satisfaction of the patients receiving FPD and evaluated the status of their oral health and oral hygiene practice awareness by the means of a framed questionnaire. They observed that more than eighty four percent patients of their study were satisfied by their fixed prosthesis.

In addition, from figure 2 it can be seen that, more than three quarters of both patients female and male were satisfied 77.57% and 87.18% respectively. There was no significant difference $P>0.05$ related to satisfaction level between female and male in the present study. This finding is similar to those reported by previous study (Singh, 2017). Different factors may influence patient satisfaction with their dentures. Apart from psychological factors, other factors include quality of the denture bearing area, patient's age and ability to get used to a denture, status of abutments, relation between horizontal and vertical dimension of occlusion, position of patient's teeth in the mouth (Abouelkomsan et al., 2012). This survey thus showed the areas were the patients are satisfied and dissatisfied. These can help to improve the treatment measure and to provide better patient satisfaction. The present study focused on patient's satisfaction, while the clinician aspect was not evaluated. Anderson (Anderson, 1998) asserted that the level of satisfaction of both clinicians and patients have to be taken into consideration. However, many researchers found that the level of patients' satisfaction exceeded that of their dentists (AL-AlSheikh, 2011; Siqueira et al., 2013; Wu et al., 2012). This finding might be the result of the different criteria used for the evaluation by each of the dentist and the patient. Dentist evaluation mainly emphasizes the technical characteristics of the prosthesis, while patients' reflection is usually subjective including convenience, esthetics, and well-being (Zlatarić & Čelebić, 2001). It will be interesting to undertake another study in Libya where the level of satisfaction of both the patient and dentists are assessed and statistically compared.

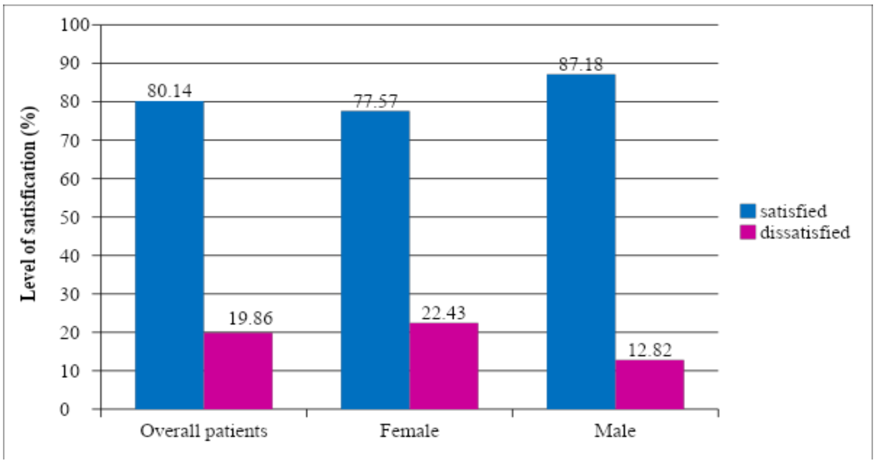

Figure 2: The level of patient satisfaction in general

Regarding to dental bridge esthetics, in spite of the fact that shade and colour assume a vital part in patient's fulfillment with their dental bridge, about 86% of the patients were satisfied with the aesthetic result of the treatment, despite the fact that about 14% answered dissatisfied with tasteful outcome. This result is consistent with the findings of (Geiballa et al., 2016; Mohammed et al., 2017; Siqueira et al., 2013). Tin-Oo et al., (2011) found that only 47.2% were satisfied with the appearance of their teeth, a lower percentage than in previous studies of different populations. For example, a study of 1014 patients at a dental school in Ankara, Turkey found that 42.7% were satisfied with their dental appearance (Akarslan et al., 2009) as were 76% of stratified sample of adults in the United Kingdom (Alkhatib et al., 2005). According to Vallittu et al., (1996) who reported that, attitudes and perceptions towards dental appearance are differ among populations and among individuals in a population. When overall dental appearance is considered, several factors are of significance, especially of the anterior teeth. Each factor may be considered individually, but all components together act in concert to produce the final esthetic effect (Qualtrough & Burke, 1994). The patient's dissatisfaction may be related to the following reasons: mismatch in color with the natural teeth, mismatch of shape and size or improper artificial tooth position in the fixed prosthesis (may be due to laboratories fault). Therefore, it is important for the clinician to pay a great attention to select the proper shade of the prosthetic teeth particularly where anterior teeth are involved. Another important aspect is matching the position and angulation of the prosthetic teeth and natural teeth. Esthetic plays a chief role in acceptance of dental bridge, it is consider as the main factor which can influence the success of treatment. Understanding fulfillment information is a critical wellspring of data that can control dental specialists to give prosthodontics treatment that will satisfy patient's desires. From the results, they concluded that high degree of satisfaction exists in patients receiving FPDs. They also concluded that in relation the post-fixed instructions of the FPDs, patient's knowledge is insufficient.

As for phonetics, results indicate that only fifteen patients 10.27% from total of one hundred forty six patients were dissatisfied and almost all participants showed improved sign of speaking. This concur the results of previous studies Geiballa et al., (2016) how reported that the majority of the patients had no speech disturbances as a result of their prosthesis. In contrast, Wismeijer et al., (2013) investigation on patient satisfaction of dental implant where it was concluded that there was no significant improvement in speech which was more difficult to explain. Speech could be influenced by the positioning of anterior maxillary teeth. The position of the anterior maxillary teeth was not changed during the different treatment phases. There was however, an insignificant decrease of satisfaction in speech seen in the results of the first visual analogue scales, whereas the second visual analogue scales showed a significant improvement of satisfaction in speech.

As for masticatory functioning, this considered as the most important factor for any patient treated with dental bridge, in the present study about 81% of patients were satisfied while less than one fifth of the participants 19.18% were dissatisfied. There are many aspects that have to be considered when masticatory function with fixed prosthesis is evaluated such as inaccurate vertical dimension, intermaxillary malocclusion between the prosthesis and natural teeth, and pain during mastication. These findings are in agreement with Kashbur & Bugaighis, (2019) who's reported that, when the participants were questioned in detail about their satisfaction, less than quarter of the sample 21.6% were not contented with the masticatory function. Also Mohammed et al., (2017) observed that majority of the patient population were satisfied by their FPDs in relation to mastication. In contrast, Geiballa et al., (2016) assessed a total of 192 patients with FPDs, who filled the questionnaire form which included assessment of their perception regrind the masticatory functions. They observed that only 46.4% of the patients had satisfaction in relation the chewing ability. Ahmed & Faruqui, (2015) conducted a cross-sectional study and analyze 200 partially edentulous patients who underwent oral rehabilitation by removable or fixed prostheses. They evaluated the satisfaction of the patients’ with the criteria of Likert scale. They assessed the level of satisfaction of the patients for factors namely phonetics, mastication and aesthetics. They observed positive Likert scale score in all the factors in the patients. From the results, they concluded that a high level of satisfaction exists in patients who undergo prosthetic treatment showing the positive impact of the prosthesis on the patients’ oral health. In addition, Tan et al., (2005) retrospectively analyzed the satisfaction level of the patients who went oral rehabilitation by FPDs. They framed a questionnaire consisting of

15 questions based on the patients' subjective perception in relation to the FPD treatment. They assessed the patient's satisfaction levels in relation to aesthetics, mastication, speech and comfort levels. They observed that a very high levels of patient satisfaction in relation to the functional aspects of FPDs. From the result, they concluded that satisfaction for the replacement of missing teeth by FPDs existed in more than ninety percent of the patients. Thus, patients have to be aware that having the continuous checkups after receiving their prosthesis is important to avoid additional impairment to their masticatory ability.

Evaluations of treatment outcomes by clinicians do not necessarily correspond to the patients' own judgment which included both function and psychosocial adaption. Patient concerns are mainly related to function, comfort, and esthetics, especially for implant fixed prosthesis. Factors such as design of FPD, material used in FPD and antagonist teeth also affects the outcome of treatment and patient's satisfaction (Creugers & De Kanter, 2000). FPD is the term used for denoting the partial dentures that is cemented to the natural teeth or root thereby furnishing and providing primary prosthesis support. Healthy occlusion wit longevity of several years can be achieved by FPD which transforms unhealthy poor functioning dentition into a comfortable one. Prosthesis failure in the patients rehabilitated with dental treatment can affect the periodontal health of the abutment teeth (Cibirka et al., 1997).

In relation to the cost of dental bridges made, only about 38% of patients were satisfied and more than half 62.33% of patients were dissatisfied. This finding is in accordance with findings reported by Chezhian, (2016) who conducted a survey on the patients who received FPD by framing a questionnaire of 16 questions. From the results, they concluded that patients are highly unsatisfied in relation to the financial obligation for the treatment. A parallel study was also completed by Ahmed & Faruqui (2015) wherein the results were quite comparable with the results of the present study.

In addition Walton & Layton, (2017) mentioned that even though satisfaction with costs was initially low, patients became more satisfied when the single implant crowns were in their mouths for a period of time. This finding may indicate that patients felt they were getting value for their money, and this may be the result of low failure and complication rates. In addition, younger patients might have found it more difficult to pay for treatment, which may have resulted in a greater awareness of the outcomes achieved. Lower satisfaction scores for appearance and costs among younger patients likely are related, and each domain affects the other.

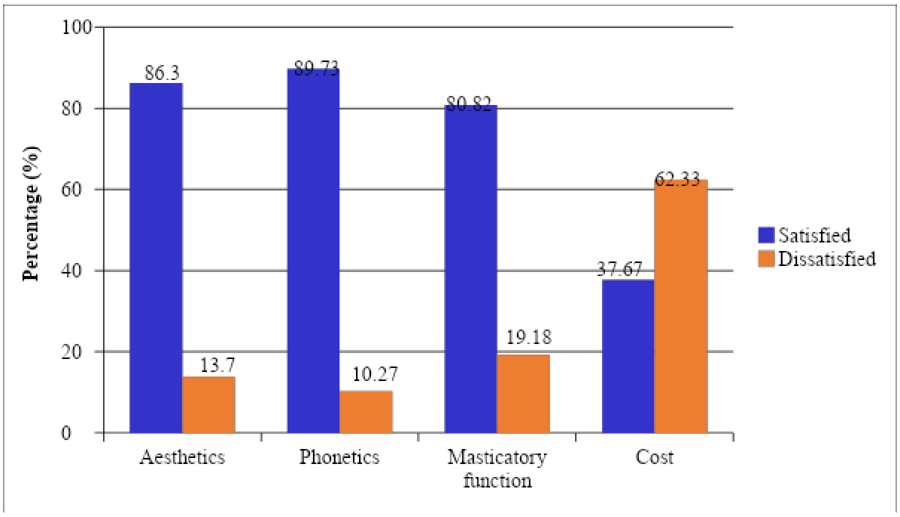

Figure 3: Level of patient's satisfaction of some dental bridge aspects.

CONCLUSION

The present study shows that the patients are generally satisfied with the outcome of dental bridges therapy and male were more satisfied than female from the treatment but no significant difference. More than half of patients were not satisfied in the financial obligation. In view of our findings, practitioners should focus on patient centered outcome for success of dental prosthesis.

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The response of equilibrating potassium chloride and soil texture to equilibrium K^+ concentration and buffer power

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Abstract
This experiment has demonstrated that estimating the K^+ sorption properties of soils was influenced by both soil type and the K^+ salt (KCl) used in the equilibration procedure. Equilibration with KCl produced the highest estimates of K^+ equilibrium concentration. The heavier textured soil generally had a higher equilibrium K^+ concentration and K^+ buffer power than the lighter soils. Possible reasons for these influences could be attributed to 'Soil type' reflects the different textures of the soils, that is, their contrasting mineral and organic matter compositions. Both K^+ equilibrium concentration and K buffer power in the heavier textured soil were higher than light textured soils; this could be attributed to different components of soil such as the presence of clay minerals in their texture and very high CEC. The mean values of K^+ equilibrium concentration and K^+ buffer power in all three soils had affected by potassium chloride. The highest value was recorded in clay soil as compared with other soils. Increased potassium concentration in soil solution at all three soils by increasing the level of potassium salt; this could be attributed to shortage of potassium in the soil solution. Finally, the mean values of potassium equilibrium concentration and buffer power in all treatments was affected by potassium chloride salt. This could be attributed to the concomitant ions that can affect dissolution of potassium bearing minerals.

Introduction

Soil potassium is usually existing in four forms: soluble in soil solution, bound to exchangeable sites, potassium non-exchangeable, and potassium in soil minerals [1]. These forms are often in dynamic equilibrium between themselves and the availability of potassium to the plant is governed by dynamic interactions between its various pools [2] Non-exchangeable potassium can be an important reservoir of potassium in soils. Some studies have demonstrated that non-exchangeable potassium reserves make an essential contribution to crop potassium supply [3,4]. The amount of non-exchangeable K^+ in soils depends on the clay content where vermiculite, mica and illite are considered the minerals which have the greatest capacity to fix K^+[5].Potassium buffer power has been defined as the relationship between quantity (Q) and intensity (I). The relationship between potassium quantity and intensity is usually used to assess the supply of potassium from soil to crops and defines the soil's K^+ buffering capacity [6,7].

Thus, potassium buffer power (KBP) can be estimated by calculating the Q / I relationship. The parameters of Q / I are more reliable predictors of K^+ absorption by crops than exchangeable K^+ (which is usually determined by extraction of soil with 1 M NH_4OAc) and helps us to understand the mechanism of potassium provision to crops [8,9].

When K^+ in soil solution gradually decreases because of plant absorption, potassium is released from exchangeable sites to the soil solution in order to compensate the deficit for the crops. However, potassium ions will adsorb on the soil when the activity ratio in soil solution increases.

This description of K^+ dynamics in soil shows the theoretical dependence of K^+ sorption on the concentrations of other cations. However, in practice, K^+ buffering characteristics can be estimated using a more simple approach, such as that described by [10], and which is followed here. This simpler alternative involves determining the relationship between exchangeable potassium (cmol kg^{-1}) and potassium concentration in solution in 10 mM $CaCl_2$. However, we do not know if the identity of the K^+ salt used to equilibrate soil samples could influence estimates of K^+ equilibrium concentrations or buffer power; that is, does the identity of the anion in the equilibrating solution matter?

Potential buffering capacity has been defined by [11] as the capacity of the soil to maintain the intensity of potassium in the soil solution. A soil with high buffer capacity will have large capacity to maintain the K^+ intensity. Numerous researchers have evaluated availability of K^+ in soil solution by estimating K^+ buffer power. For example, [12] tested soil samples collected from 41 soil profiles at 100 cm depth. They found that K^+ buffer power ranged from 0.02 to 7.0 cmol kg^{-1}, and the highest buffer power was recorded in fine-textured soils.

The uptake of potassium by plants is not only related to available potassium, but also to the capacity of exchangeable potassium supply. When the potassium activity ratio decreases in the soil solution due to uptake by plant roots, the potassium on exchangeable sites will be released. However, if the available potassium decreases rapidly as a result of absorption by the plant, and potassium buffer capacity of exchangeable sites is low, then potassium should be applied as fertiliser to compensate for the deficiency of nutritional potassium [13]. [14] found that K buffer power is depended on soil texture and there is a linear relationship between potential buffer capacity and cation exchange capacity (CEC). If the CEC for soil is high the adsorption sites will have high K^+ buffering capacity. [15] studied K buffer capacity PBC of four sandy soils (from Vietnam sea coast) as correlated to soil properties. Their calculations depended on the following equation

$$PBC = K_{ex} / ARk = K_G * Ca_{ex}$$

$$\text{With} \qquad AR_k = (K) / (Ca)^{1/2}$$

Where K_{ex} and Ca_{ex} are K and Ca exchangeable (cmol kg^{-1}) and K_G is the Gapon selectivity coefficient and ARk is the potassium activity ratio. K_G is "related to the type of exchange sites and to the potassium saturation of the cation exchange capacity" [15]. According to the above equation, PBC relies on two things: K_G and the cation concentration on exchangeable surfaces that competes with potassium. However, [15] found that soil texture was the most important of soil properties influencing buffer capacity; humus content, for example, had a relatively small effect. All soil samples had a very low potassium activity ratio (0.03 to 0.07 cmol kg^{-1}) due to reduction of exchangeable potassium content.

Rationale

According to theabove introduction the potassium movement in soil solution to the plant and their availability in the soil is based on its equilibrium concentration and the soil's buffer power. These properties are used to estimated by equilibrating soils with solution of known K^+ concentration. However, as explained above, it is not known how such measurements are affected by potassium chloride nor if the texture of the soil (which will be related to its ion exchange capacity) is important. Therefore, the experiment studied to address these issues.

Hypotheses

The K^+ equilibrium concentration in the soil solution and soil K^+ buffer power is affected by potassium chloride salt used for soil equilibration.

Materials and methods

Three surface soil samples were taken from depth of 0-30 cm. The samples were air-dried at 25 ^oC, ground and passed through a 2 mm sieve to remove debris and stone particles. Soil samples were collected from three different agricultural areas. These soils samples belong to different orders and are categorised according to their physio-chemical properties such as texture and soil pH, where pH was measured in a 1: 2 soil/water suspension [10] as illustrated in Table1.

Table1. Chemical and physical properties of soils used in this experiment.

Parameters	Soil 1	Soil 2	Soil 3
pH water (1:2.5)	4.9	4.3	5.4
Texture*	Silty Clay Loam	Loamy Sand	Sandy Loam
Organic matter %	7.6	7.6	7.9

The procedure used to estimate K^+ sorption isotherms is described fully by [10]. All soil samples were treated with six concentrations of different potassium salts. The salt concentrations were 0, 0.5, 1, 2, 3, and 5 mM K^+ in 10 mM $CaCl_2$. The salts which were selected for the experiment was potassium chloride (KCl). Three replicates were analyzed. This salt was used to evaluate the response of K^+ buffer power and K^+ equilibrium in the soils to K salts. 25 ml of solution were added to 5 g of air-dried soil in a conical flask. The soil suspensions were shaken for 2 hours and left to stand 2 hours before filtering through Whatman 41 paper.

Effects of soil type and equilibrating salt on K^+ equilibrium concentrations and K^+ buffer power were tested using analysis of variance (two-way general linear models) in Minitab. Where residuals of data were not normally distributed, data were log-transformed where appropriate.

Exchangeable K^+ in each sample was measured by an AtomicAbsorption Spectrophotometer (Perkin Elmer A Analyst 100 AAS) that had been pre-calibrated using the standard solution for each salt. K^+ was measured using wavelengths of 766.5 nm, to calculate the relationship between K^+ exchangeable and K^+ in soil solution to determine K^+ equilibrium. Q/I isotherms were estimated according to the procedure described by [10]. Potassium buffer power was estimated by fitting quadratic equations to the data as described below.

Results

The effect of soil texture and potassium chloride on K^+ equilibrium concentration insolution.

Negative values in Table 2reflect the desorption of exchangeable K^+ into the equilibrating solution, i.e., they show the change in K^+ concentration (Rowell, 1994).

Table 2. Mean concentrations of K^+ remaining in solution after equilibrating soils with potassiumchloride. is the initial K^+ concentration of the equilibrating solution after equilibration.

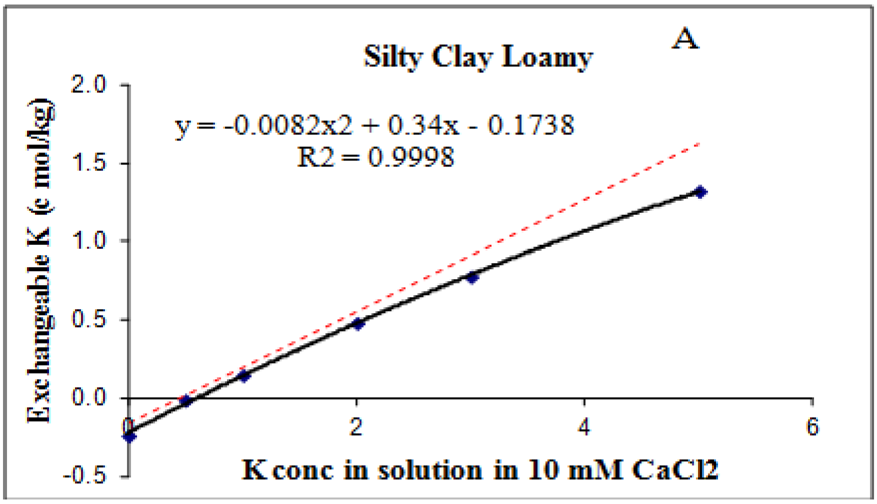
Conc cmol kg^{-1} Soil	0 ±SE	0.5 ±SE	1 ±SE	2 ±SE	3 ±SE	5 ±SE
Loamy Sand	-0.05 0.01	0.01 0.01	0.06 0.01	0.16 0.04	0-35 0.01	0.56 0.01
Sandy Loam	-0.09 0.01	0.04 0.01	0.17 0.01	0.36 0.02	0.59 0.02	0.87 0.03
Silty Clay Loam	-0.24 0.01	-0.01 0.04	0.15 0.02	0.48 0.03	0.78 0.04	1.32 0.01

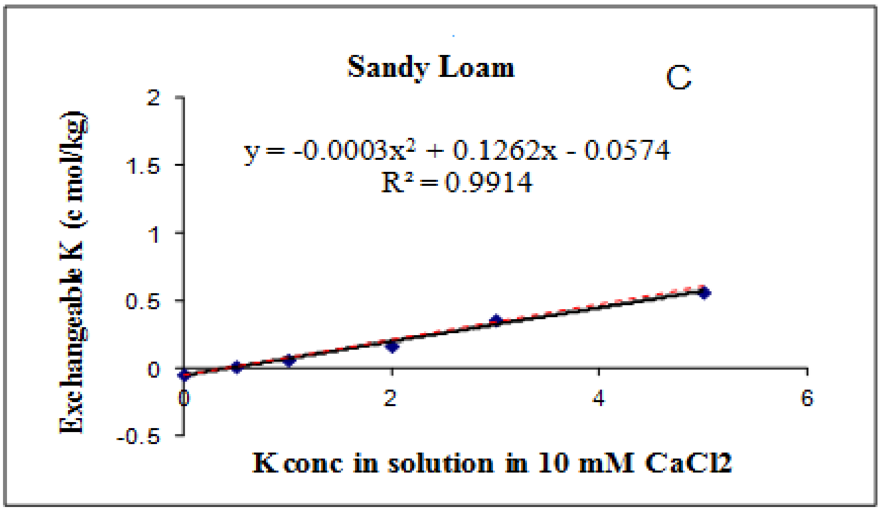
In Sandy Loam soil, the highest K^+ concentration was recorded when salt concentration was 5 cmol kg^{-1} . A similar same effect was seen in the other soils, but more K^+ remained in solution in Loamy Sand and

Silty Clay Loam soils. Differences between soils were presumably related to their different textures and sorption characteristics of their component minerals and organic matter. The K^+ concentrations shown in Table 2 were used to construct K^+ sorption isotherms, from which equilibrium K^+ concentrations and buffer powers were derived.

K equilibrium concentration and K buffer power

The K^+ sorption isotherms of all soils were well described by quadratic functions ($R^2 > 0.97$). Both Keq and KBP were significantly affected in all soil textures when equilibrated with KCl ($P < 0.002$, 0.001 respectively). The values of Keq and KBP changed from soil to soil according to their texture. Fig 1 illustrates these effects. Loam Sand soil showed stronger K adsorption compared to Sandy Loan and Silty Clay Loamsoils. The value of Keq when exchangeable K corresponds with K concentration in soil solution (i.e., when Y=0) estimated from quadratic equations ranged from 0.34 to 0.50 mM. K is released in to soil solution from exchangeable sites and is available for uptake by plants after equilibrium concentration is reached for each soil. The ability ofLoamy Sand soil and Sandy loam soil to release K in soil solution were broadly similar (0.28, 0.24 mM respectively), whilst the equilibrium concentration of K in the Silty Clay Loamy soil was higher than in the other two soils.





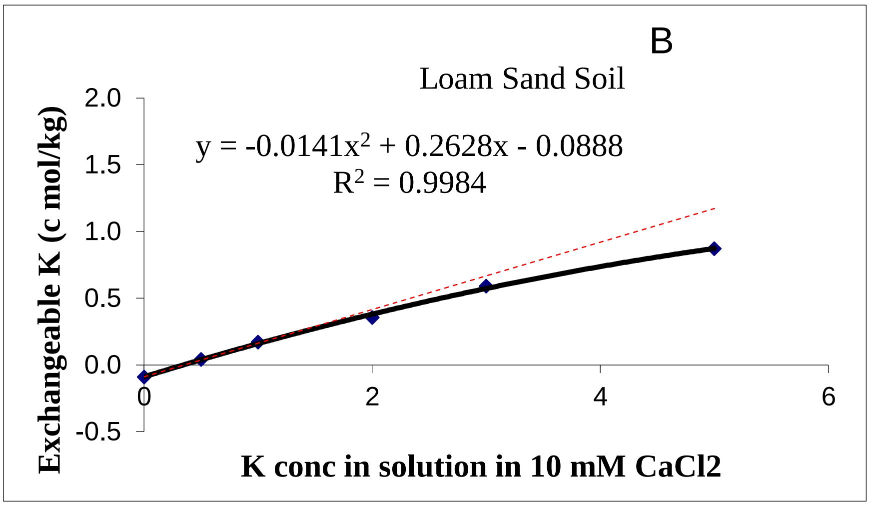


Fig 1 (A, B and C). The effect of different concentrations of KCl on potassium equilibrium concentration (Keq) and buffer power (KBF) in three different soil texture. Symbols are means of three replicates. The bold curve is the quadratic function fitted to the data. Keq is defined as the value of x when y = 0. The broken line is the tangent to the quadratic curve when y = 0 and its slope at that point = KBP.

Table 3. Mean (± SE) equilibrium potassium concentrations and buffer powers (*n* = 3). Means in the same column followed by different letters are statistically different at P = 0.05.

Soil	Salt	Equilibrium potassium mM	Buffer power cmol kg^{-1} $(mM)^{-1}$
Sandy Loam	KCl ±SE	0.42 b 0.04	0.12 a 0.02
Loamy Sand	KCl ±SE	0.34 b 0.01	0.25 a 0.01
Silty Clay Loam	KCl ±SE	0.51 c 0.02	0.33 a 0.01

The mean values of potassium equilibrium for all three soils were significantly affected when equilibratedwith KCl. For example, the greatest value of Keq was recorded in Silty clay loam (0.51 mM), while the lowest values were recorded in Sandy loam soil (0.34 mM). This means soil that has a higher Keq will have the ability to provide potassium to growing plants for a long time when compared to the soil with less Keq. Silty clay loam and Sandy loam soilsreleased potassium when Keq was ≤ 0.51 and 0.42 (mM) respectively as compared with ≤ 0.34 (mM) for Insch soil. The Silty clay loam soil had a higher Keq than The Loamy Sand andSandy Loam soils(Table 3).

All three soils when equilibrated by potassium chloride salt showed positive correlation r^2 = 0.99 (Fig 1). The gradient of intersection point with the X-axis is KBP. K^+ buffer power for all three soils was not significantly affected by KCl (Table 3). However, the mean values of soil's buffer power responded to KCl according to their texture, where soils which contained clay minerals in their texture had higher buffer power than light texture in all three replicates. Thereby, the highest KBP was recorded in Silty clay loam soil (0.33 cmol kg^{-1} $(mM)^{-1}$) then Loamy Sand soil (0.25 cmol kg^{-1} $(mM)^{-1}$), and the lowest buffer power was in Sandy Loam soil (0.12 cmol kg^{-1} $(mM)^{-1}$; Table 3). These results confirmed the hypothesis that potassium equilibrium concentration and soil K buffer power are affected by type of potassium salts; whereas all results showed that K^+ equilibrium concentration and soil K^+ buffer power of the same soil vary depending on the type of salt used. 'Soil type' reflects the different textures of the soils, that is, their contrasting mineral and organic matter compositions. For example, in this experiment, both K^+ equilibrium concentration and K buffer power in the Silty Clay soil were higher than Loamy Sand and Sandy Loam soils; this could be attributed to different components of soil such as the presence of clay minerals in their texture and very high CEC. [16] estimated initial short-term K^+ buffer power, potassium equilibrium and other parameters on 15 different soil textures. They found that increase K^+ buffer power when CEC increased. However, [17] tested 15 soils from Iran and found in their experiment that the relationship between K^+ buffer power and CEC was very poor due to highly differences in the physical and chemical properties of the soils ($R^2 = 0.43$, $P < 0.01$). [15] tested K^+ buffer power for different soil textures, and found that soils that contain relatively large amounts of clay minerals (i.e., 6 %) have a high potassium buffer power compared to soils that contain a lower percentage of clay (2 %). Clay soils have more ability to hold nutrients such as K^+, Mg^{2+}, and Ca^{2+} than sandy soils due to large surface area and high CEC. Thereby increased K^+ buffer power could be attributed to a greater amount of K in clay soils or high CEC soils. These findings are supported by [11] who tested the influence of different rates of KCl (0, 125, 250, 500, 1000 and 2000 mg K^+ kg^{-1}) on soil parameters such as K buffer power. He found that all forms of potassium in the soil increased with a higher potassium

The highest mean value of potassium equilibrium concentration in all three soils was recorded when they equilibrated with KCl, while the contrary was observed in the mean value of potassium buffer power whereas the lowest mean value in all soils when soils equilibrated with KCl. the highest mean value of K^+ equilibrium concentration and potassium buffer power was obtained in soil that contained high amount of clay content. This is due to the presence of clay mineral in their texture [15].

Conclusion

This experiment has demonstrated that estimating the K^+ sorption properties of soils was influenced by both soil type and the K^+ salt used in the equilibration procedure. Therefore, the hypotheses were supported by the results. Equilibration with KCl produced the highest estimates of K^+ equilibrium concentration

‘Soil type’ reflects the different textures of the soils, that is, their contrasting mineral and organic matter compositions. both K^+ equilibrium concentration and K buffer power in the clay soil were higher than loamy and silty soils. Clay soils have more ability to hold nutrients such as K^+, Mg^{2+}, and Ca^{2+} than sandy soils due to large surface area and high CEC

The lowest mean value of K^+ equilibrium concentration and buffer power was recorded in sandy soils, while heavy soils with high clay content were much more highly buffered. In this case, soils which have high buffer power is quickly replenished when the nutrient is absorbed from soil solution or have sufficient K^+ in reserve to compensate for K^+ used by plants whilst soils of low buffer capacity will replace used K^+ slowly. Because the soils used in this experiment were collected from different locations (in order to obtain samples with contrasting textures), they could also have been subjected to different management histories, in particular, fertiliser applications. Thereby, different management histories especially fertiliser application could have influenced the experimental results.

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Analysis and Study Of Backflow Effect On Well Pumps

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Abstract
This paper presents the investigations of operating parameters of a deep well pump No(150-D_1), one of the production wells located at EJH (East Jabal Hasouna) wellfield of Great Man Made River Project, the investigated parameters of a deep well pump are (flow rate, pressure, liquid level and speed) without NRV (Non Return Valve) at the pump head in steady conditions and the transient conditions after shut – down of the pump.

1.INTRODUCTION

The proper placement of (NRV) non return valve hold water pressure in the system, when the pump stops, they also assist in the smooth operation of the water system and extending the life of a pump and system by preventing backflow to the pump which cause the pump rotate in reverse direction and cause also up-thrust and water hammer.
In the current conditions of well pumps at East Jabal Hasouna (EJH) well field, which has one non return valve (NRV) installed in the horizontal line after the well head, during our consultations work on the Hasouna – Jeffara System, we request to make sure if one (NRV) is sufficient for safe operation of the pump, however, we carried out this study as well as calculations to determine the effect that might arise after the shut-down of
pump units.
If only one NRV (non return valve) is installed at the well head as shown in fig1. And no NRV is installed on top of the pump, the backflow calculations will show the actual backflow velocity that is expected during pump operation, based on the well – and draw down data given by the GWA (General Water Authority).

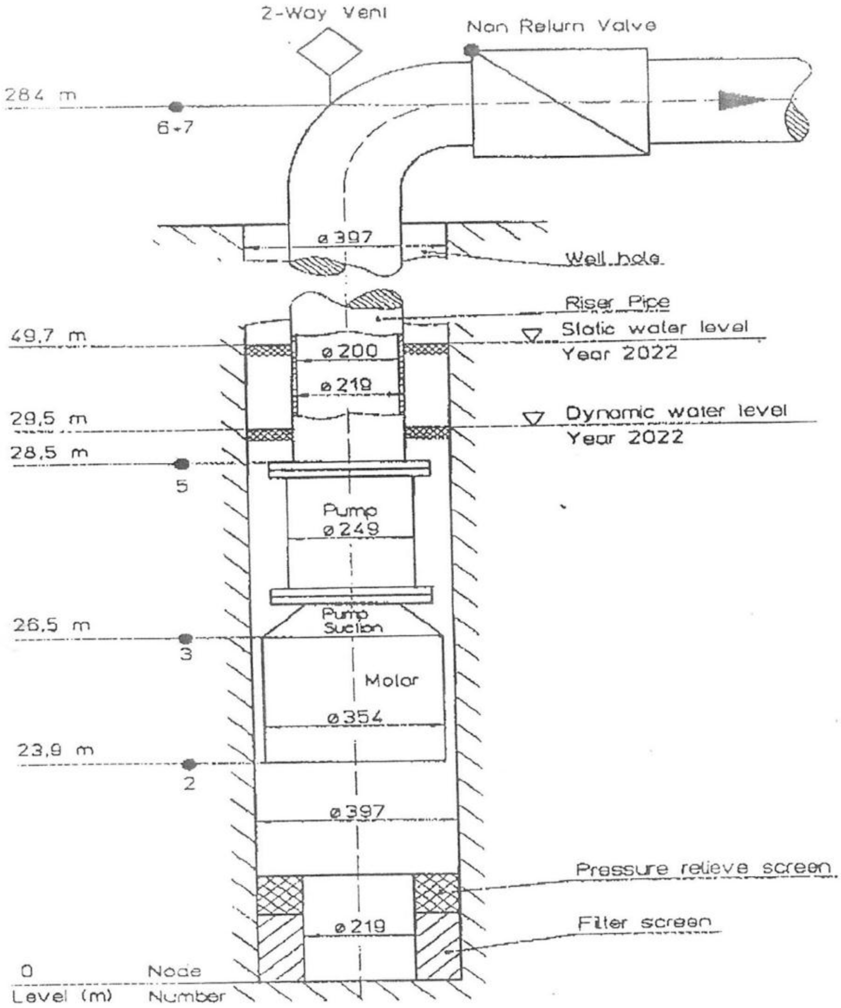

Fig.1 represents the major well dimensions with the position of NRV

2. Discussion of results

2.1. Computational Model

For this investigation we selected well No(150-D_1) as a worst case installation, the operating conditions are based on the deep well pump QM101 with 7 stages as offered, and expected conditions in the year 2022.

Fig.1 defines the major well dimensions, which were used for the computational model as defined in **Fig.2**, this model is made up of individual components and connecting nodes.

Assumptions:

• In the absence of actual data we had to make assumptions, which could influence to some
degree the results.

• The dynamic draw down of the water level was assumed to be the same in the year 2022
as in present.

• The pressure loss of the filter screen (component 4) was calibrated to obtaining the
dynamic draw down.

• We arbitrarily assumed a reduced filter loss of 14% in reverse flow condition compared
to the loss in normal flow direction.

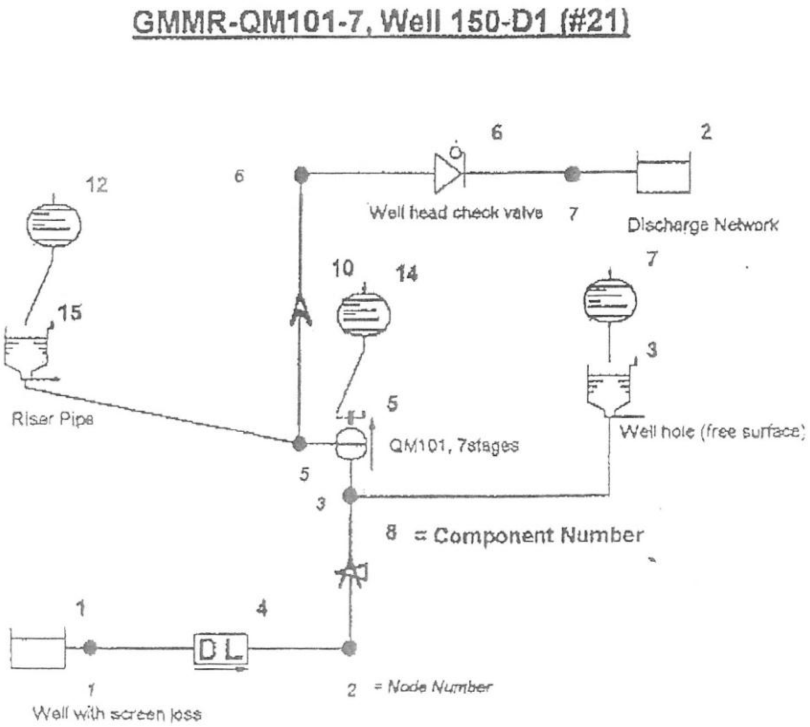

Fig.2 Scheme of computational network with components and nodes.

2.2. Results Of Steady State Calculation

This calculation serves to calibrate and NRV the assumptions of the computational model and provides the starting data for the transient calculation.

Fig.3 shows the flow rate Q =215.8 m^3/h in normal operation, based on the static pump head, friction loss and pump performance curve.

Fig.4 depicts the absolute pressure at the nodes, for instance the pressure at the node 3 = 3.859 bar represents a dynamic water level of (3.859-1.03)*10.2 = 28.9m, which is close enough to the assumed 29.5m.

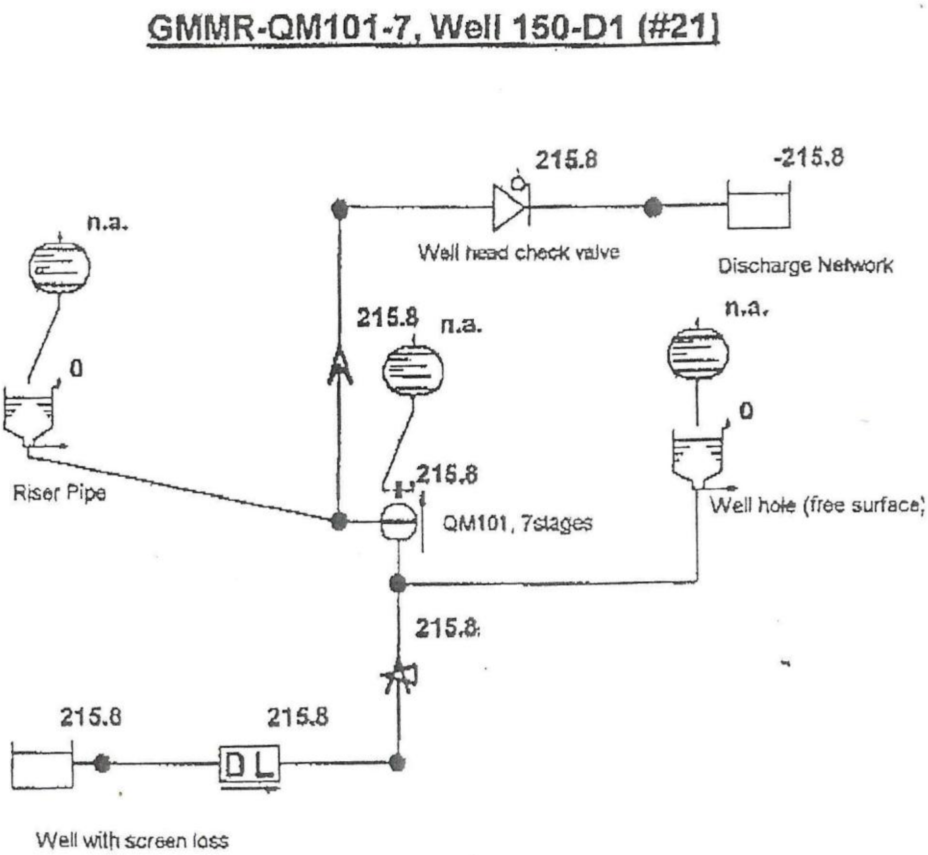

Fig.3 Represents the flow rate Q[m^3/h] in normal operation.

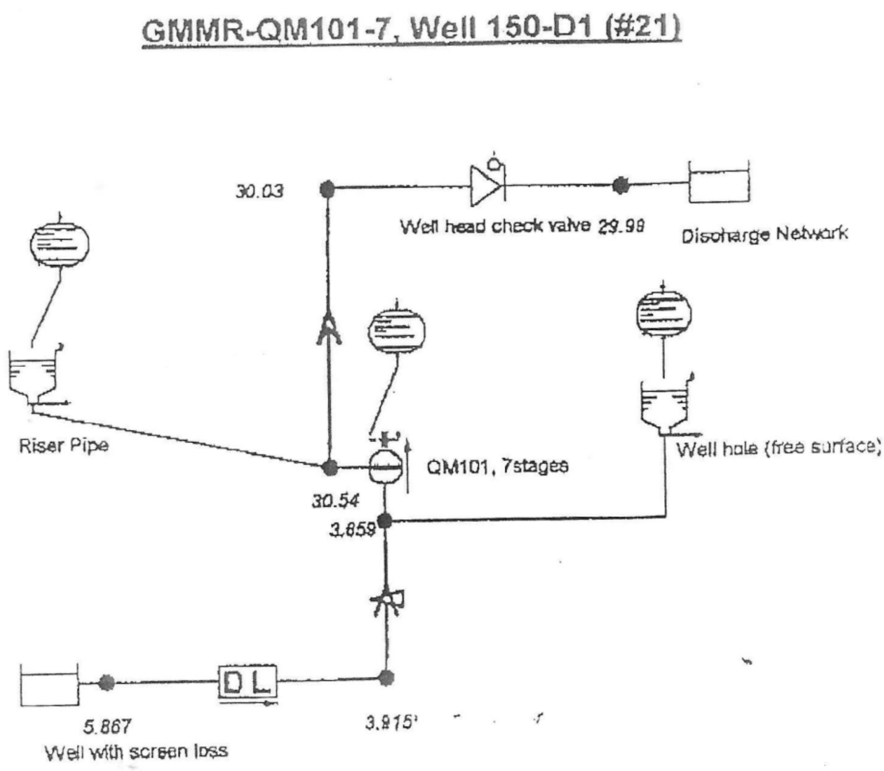

Fig.4 Represents the Pressure at Nodes in [bar].

Table.1 Node Collection: GMMR_QM101:V

ID	Pressure [bar]	Level [m]	Fluid identifier
1	5.86683	23.9	1
2	3.91478	23.9	1
3	3.85915	26.5	1
4	30.5359	285	1
5	30.0342	285	1
6	29.9855	284	1

2.3. Results Of The Transient Analysis

<u>Pump Speed:</u>

Fig.5 shows the pump speed after shut-down, the speed is reversed and the pump operates as turbine. After one second the maximum theoretical turbine run-away speed of approx. 4800 rpm is obtained. Please notice that the theoretical speed of 4800 rpm has to be used to verify the backflow calculation, the realistic maximum backflow velocity will be only 3800 rpm and cannot be calculated by FLOWMASTER program. However, a higher maximum speed causes higher filter backflow velocities and therefore the calculation is on the safe side.

Change in water level:

Fig.6 given an indication of the change in liquid level in the riser pipe (component 15) after shut-down of the pump, it was indicated from the site, that the riser pipe empties within 9 to 15 seconds, which could not be confirmed by the calculations.

Flow rates / Fluid velocity:

Fig. 7and **Fig. 8** show the instantaneous flow rates at the pump (component 5) and, more important, at the filter (component 4), since the filter reverse flow velocity is decisive for reliable operation. Based on the used data given by GWA (General Water Authority) including the type of screen , diameter and the length of screens, the average radial backflow velocity through the filter occurring after pump stop is:

1- SS Screens; c = 0.012m/s

2- GRP Screens; c = 0.012m/s

Both velocities are within the range of 0.01- 0.03m/s advised by GWA, based on this calculation an operation of the pump units without a non return valve on top of the pump is applicable because the backflow velocity through the filter is such that it will not harm the well screens.

Differential Pressure:

Fig.9 shows the pump differential pressure vs. time, driving turbine, there is a much smaller pressure differential for reverse flow, because the friction loss for reverse flow is assumed smaller than for normal flow (see assumptions).

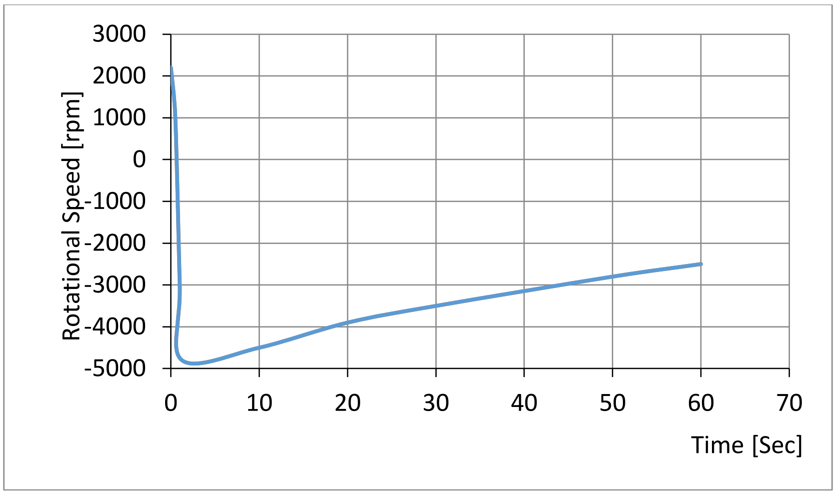

Fig.5 Pump Rotational Speed vs. Time

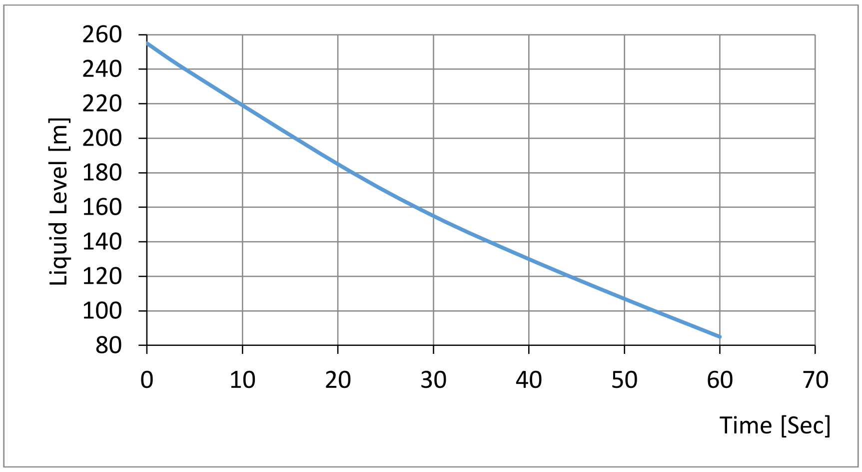

Fig.6 Liquid Level in Riser Pipe vs. Time

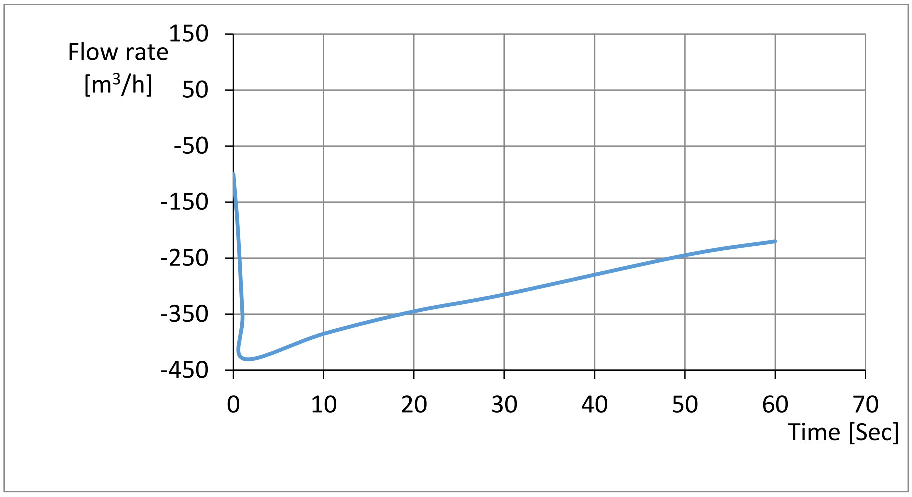

Fig.7 Flow rate of pump vs. Time

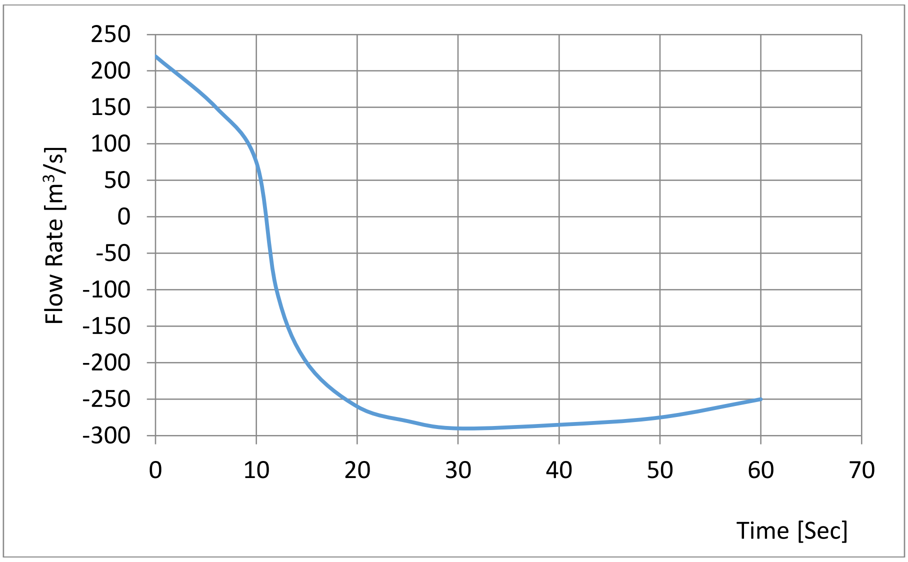

Fig.8 Flow Rate in sand Filter vs. Time

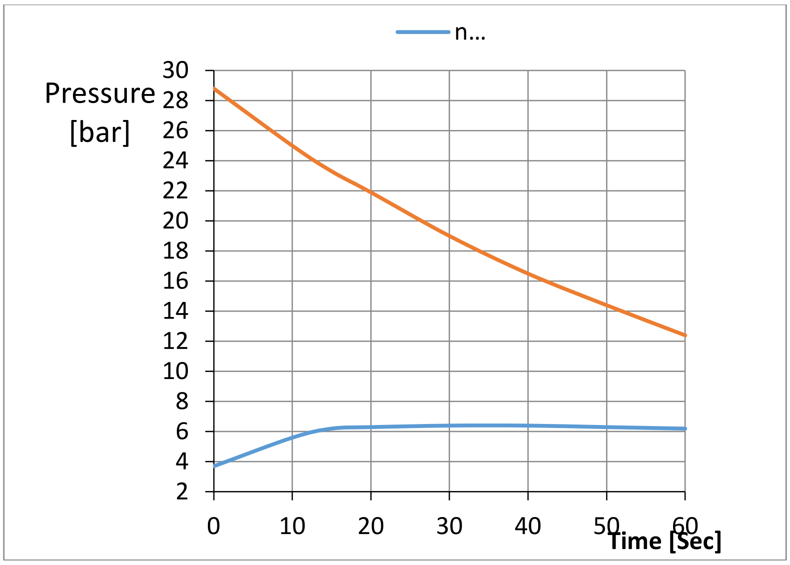

Fig.9 Pump Suction and Discharge Pressure vs. Time

3. Conclusions

The accuracy criteria of the computational model were checked taking into account the main aspects of the backflow phenomena of a particular well and found to be reasonable.

Several assumptions on components had to be made, those assumptions have always been made on the safe side, to make sure that the highest possible backflow velocity in the filter will be calculated.

The results indicate that there is no danger or disadvantage for the pump unit if it is run without an additional NRV on top of the pumps. The maximum backflow velocity through the filter is found to be no more than 0.012 m/s for both, SS screens and GRP screens.

Both velocities are within the range of 0.01 – 0.03 m/s advised by GWA (General Water Authority), based on this calculation an operation of the pump units without a non return valve on top of the pump, but only one NRV at the well head is applicable because the backflow velocity through the filter is such that it will not harm neither the well screens nor the pump unit. With the pressure relief screen, the backflow velocity will even be lower than 0.012 m/s.

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An Experimental and Computational Study Of Three-Dimensional Flow in a Centrifugal Pump with Vaned Diffuser

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Abstract
The present work describes the results of an experimental investigations which carried out at selected control planes of vaned diffuser of centrifugal pump and the results of calculations of flow by three-dimensional numerical method (3D). Numerical and experimental investigations of selected vaned diffuser pump are done to investigate the flow velocity and static pressure in the inlet and outlet diffuser.

1.INTERODUCTION

An experimental investigations and calculations for three-dimensional viscous incompressible flow have been carried out by M.Reggio and R.Camarero [1], the numerical calculations also carried out by Denton.J.D [2].
The reference [3,4] that solves the three-dimensional viscous flow of compressible and incompressible fluid.
The numerical investigations methods are widely developed for flow structure in machine elements. These methods are at present used in analysis and qualitative evaluations of velocity and static pressure distributions in hydraulic passages of machines.
The sufficiently accurate calculation of the actual flow that occurs in turbo-machines requires a numerical solution of the complete system of Navier-Stokes differential equations of motion. However, it is impossible now to design the optimal geometry of pump elements at the assumed parameters H, Q, n by means of this method.
The results of numerical calculations of the flow through the vaned diffuser channel of the selected pump type are presented and

compared with the results of experimental investigations. This analysis results from the occurrence of these quantities in both stages of the pump designing process.

2- Construction of investigated vaned diffuser

The main dimensions of the investigated vaned diffuser of multistage centrifugal pump [PM5],and the scheme of flow passages with control planes are presented here below in Table. 1 and figs.(1,2) respectively.

Table 1. Main dimensions of vaned diffuser

Pump no	D_3 mm	D_4 mm	b_3 mm	b_4 mm	α^*_3 deg	α^*_4 deg	α^*_{4b} deg	α^*_{4c} deg	S_3 mm	S_4 mm	Z_k -
PM5	370	500	27	33	10.35	23.79	31.83	15.75	5.5	2	9

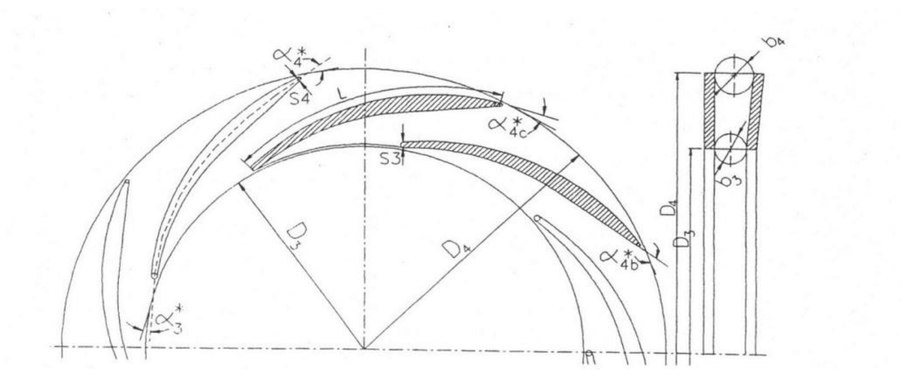

Fig 1. Geometry of vaned diffuser (main dimensions)

Nomenclature

l – blade length

v^i ,v^j,v^k – contravariant velocity component

s – blade thickness

z – number of vanes

Q- volume flow rate

x^i – co-ordinates of the hydraulic system

τ^{ij} –stress tensor

μ_{ef} – effective dynamic viscosity

ρ –density of the liquid pumped

α -slope angle of the vane

η- total efficiency of the pump.

b – channel width

c – absolute velocity

D – diameter

H – total head

£ - Jakobian

p – pressure

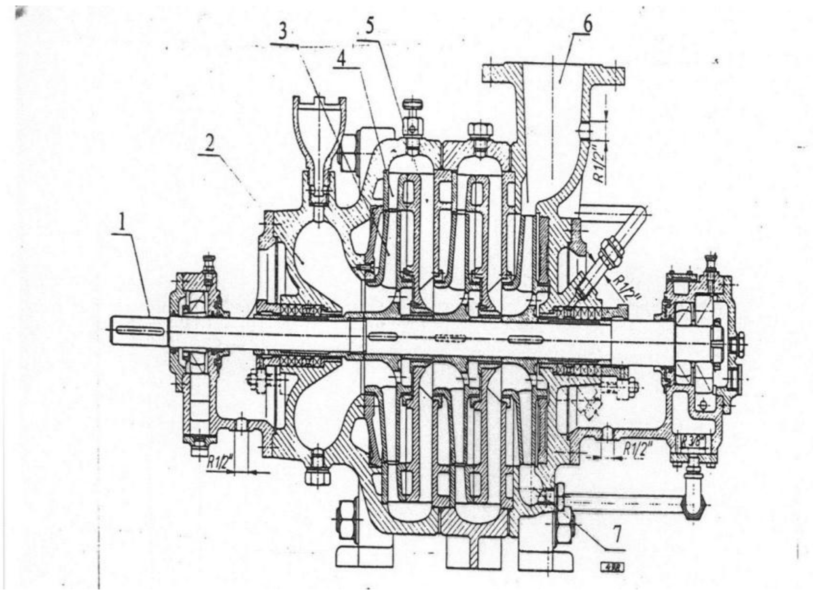

Fig. 2.Cross-section of multistage centrifugal pump [PM5], with investigated vaned diffuser.

1-shaft; 2- inlet channel; 3- impeller; 4- inlet vaned diffuser; 5- outlet vaned diffuser;

6- collector spiral; 7- connector.

3. Three-dimensional numerical method

3.1. Basic equations

For the calculation of three-dimensional flow (3D) through passages of vaned diffuser shown in fig (1),the first step is generating calculation mesh in the passage of investigated vaned diffuser which shown in fig (3), the next step is the integration of continuity and Naver-Stokes equations (Eqs(1) and (2)) shown her below, the calculation algorithm have been discussed in [3,4].

$$\frac{\partial}{\partial x^1}\left(\frac{\rho \upsilon^1}{\Im}\right)+\frac{\partial}{\partial x^2}\left(\frac{\rho \upsilon^2}{\Im}\right)+\frac{\partial}{\partial x^3}\left(\frac{\rho \upsilon^3}{\Im}\right)=0 \quad (1)$$

$$\underbrace{\partial\left(\frac{\rho\upsilon^{j}}{\Im}\right)}_{1} + \underbrace{\partial\left(\frac{\rho\upsilon^{j}\upsilon^{i}}{\Im}\right)}_{2} + \underbrace{\begin{Bmatrix} j \\ ik \end{Bmatrix}\frac{\rho\upsilon^{k}\upsilon^{j}}{\Im}}_{3} =$$

$$\underbrace{-\frac{g^{ji}}{\Im}\partial_{i}p}_{4} + \underbrace{\frac{\rho}{\Im}F^{j}}_{5} + \underbrace{\partial_{i}\left[\frac{\mu_{eff}}{\Im}\left(g^{jk}\partial_{k}\upsilon^{i} + g^{ik}\partial_{k}\upsilon^{j}\right)\right]}_{6} \qquad (2)$$

Because we consider stationary flow, we are not concerned with element (1), then in turn we name: element (2) convective element, element (3) curvilinear co-ordinate system,
element (4) pressure element,
element (5) element of centrifugal and coriolis forces,
element 6) diffusion element.
Where the centrifugal force and the Coriolis in the curvilinear system equal:

$$f^{n} = |\omega|^{2}r^{n} + 2\mathcal{E}^{njk}\omega_{j}\cdot\upsilon_{k}\,\Im$$

(3)And the stress tensor is equal to:

$$\tau^{nj} = \mu_{eff}\left(g^{jk}\frac{\partial v}{\partial x^{k}} + g^{nk}\frac{\partial v}{\partial x^{k}} - \frac{\partial g^{nj}}{\partial x^{k}}\upsilon^{k}\right)$$

(4)In the numerical calculations of flows through the selected passages of the pump, an algebraic program of the Baldwin-Lomax model of turbulence has been applied [1].In this program, the effective viscosity for the determination of stress has been presented as a sum of the following components:

(5) $$\mu_{ef} = \mu + \mu_{T}$$

Where: μ- molecular viscosity, μ_T- turbulent viscosity.
A detailed description of the determination of the viscosity μ and μ_T is presented in [1].

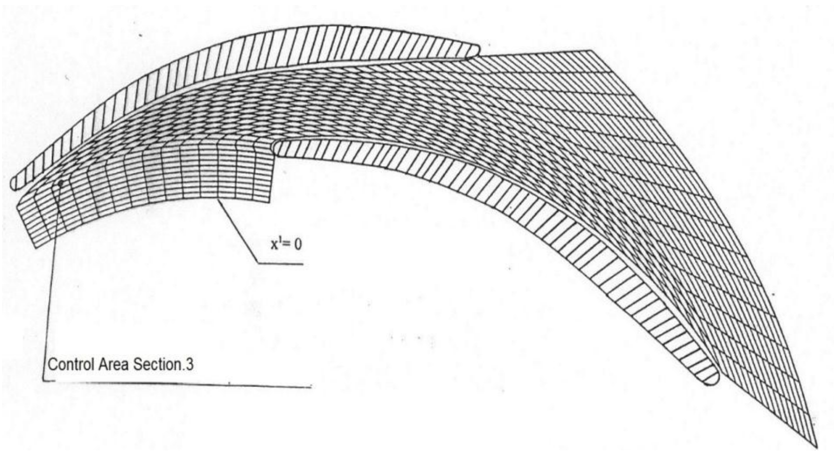

Fig.3. Computational grid of PM5 pump vaned diffuser channel .

3.2Boundary conditions

The system of Eqs. (1) and (2) is an elliptic system of partial equations that requires the following boundary conditions:

- Velocity profile at the inlet to the computational domain, in each node of computational grid, the respective velocity components are given on the inlet surface.
- Distribution and values of the static pressure at the calculation channel outlet.
- Zero gradient of the static pressure at the calculation channel outlet.
- Velocity equal to zero on the calculation channel walls.
- periodicity along the direction x^2 (the grid has been built in such a way as to make the co-ordinate x^2 correspond to the circumferential.
- constant static pressure at the outlet of the channel of the centrifugal vaned diffuser.

3.3. Calculation algorithm

For the three-dimensional calculations, an NSE (Naver-Stokes Elliptic) software package written in Fortran 77 (developed at the Technical University of Lodz by dr. Rabiega) has been applied. The code of the calculation procedure of the effective viscosity has been developed and used. These procedures allow one to generate a computational grid in an iterative way on the basis of the geometry drawn in AutoCAD , the commercial TECPLOT software is allow for the graphical presentation of velocity and pressure fields has been used. A block scheme of the calculations is presented below.

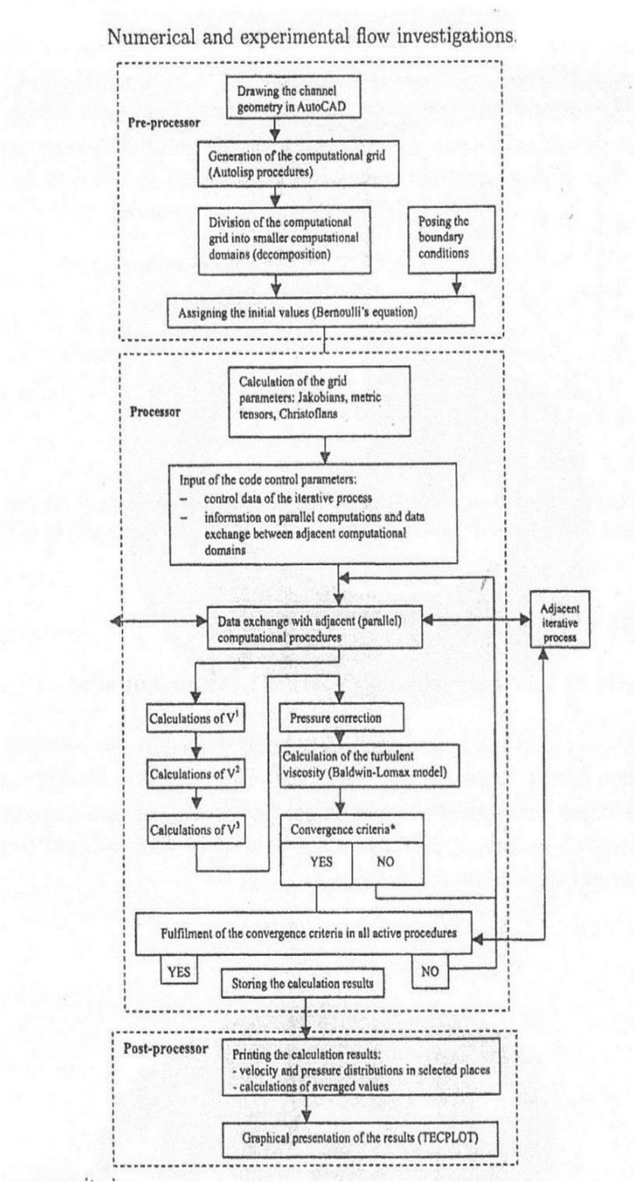

Fig.4. Block scheme of numerical calculations of 3D flow

4. Results of numerical (3D) and experimental investigations.

The results of numerical and experimental investigations conducted for the selected pump type
[PM5] are discussed.

The comparison between calculation and experimental study of investigated vaned diffuser has been carried out in order to evaluate the posed boundary conditions given in Eqs. (1) and (2), with the assumed model of turbulence.

The application of the results of numerical and experimental investigations of vaned diffuser follows from the fact that they play a decisive role in the energy transfer to the following medium and in the exchange of the kinetic energy into the potential energy .

The calculations have been carried out for three discharges, whose values are given on the diagram. The nominal discharge of the selected centrifugal pump type [PM5] is equal to $Q_N = 0.072 m^3/s$.

4.1. Results of flow calculations in the PM5 pump vaned diffuser

The geometry of the of the vaned diffuser is presented in Table. 1 and is shown in fig.(1).

The calculation extension includes the inlet and outlet region of vaned diffuser passages
in which the boundary conditions are posed for the calculations. According to section 3.2, it has been assumed that the parameters, whereas a constant static pressure has been assumed in the outlet plane of the computational domain
of the vaned diffuser **.** The computational grid of the PM5 pump vaned diffuser that comprises the blade-to-blade passage and the extended computational domain is shown in fig. (3). The computational distributions of the working medium velocity vectors in the PM5 pump vaned diffuser for the nominal discharge are presented in fig. (5).

In order to evaluate the obtained results, the velocity and the pressure fields have been averaged in control cross-sections 3 and 4 fig. (1). Thus, the averaged quantities, characteristic of the flow through the vaned diffuser, have been determined, these are:

- Mean values of the velocity components c_r , c_u at the vaned diffuser inlet and outlet
  Control planes 3 , 4.

- Static pressure at the outlet of vaned diffuser p_4.
- Mean increase in static pressure through passage of vaned diffuser
  control planes 3, 4 (Δp).

The above mentioned quantities are shown in Figs (6, 7 , 8, 9), the experimental investigations have been compared with the results of calculations made by (3D).

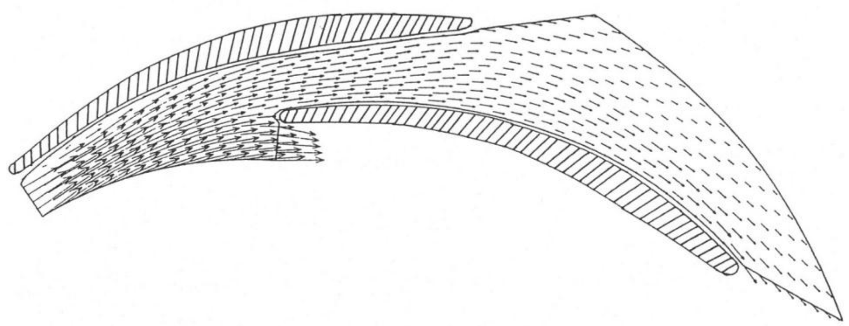

Fig.5. Vectors of velocity calculated by 3D flow

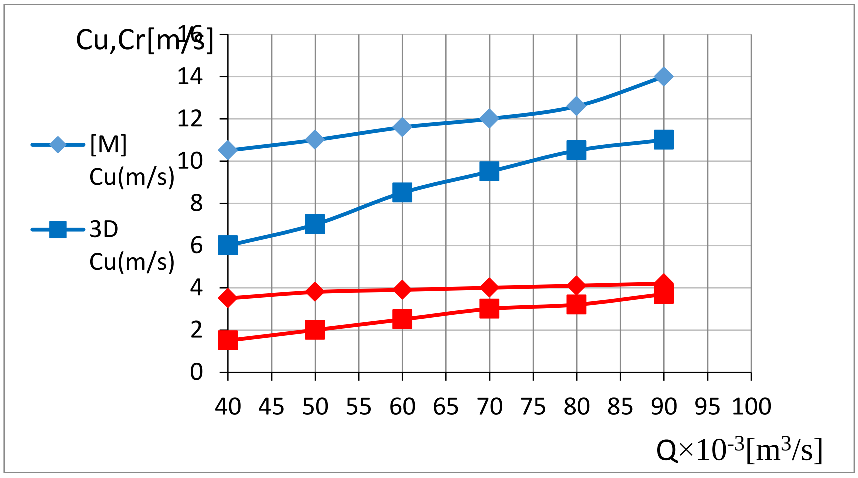

Fig 6. Flow velocity through the inlet of vaned diffuser measured [M] and calculated

by (3D).

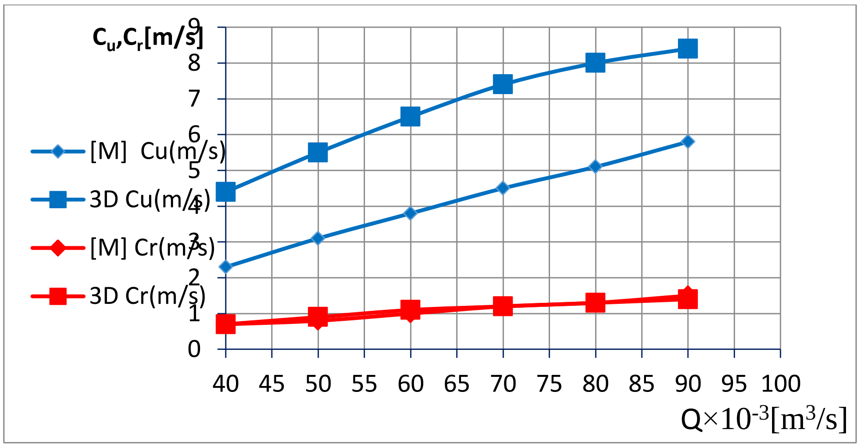

Fig7. Flow velocity through the outlet of vaned diffuser measured [M] and calculated

by (3D).

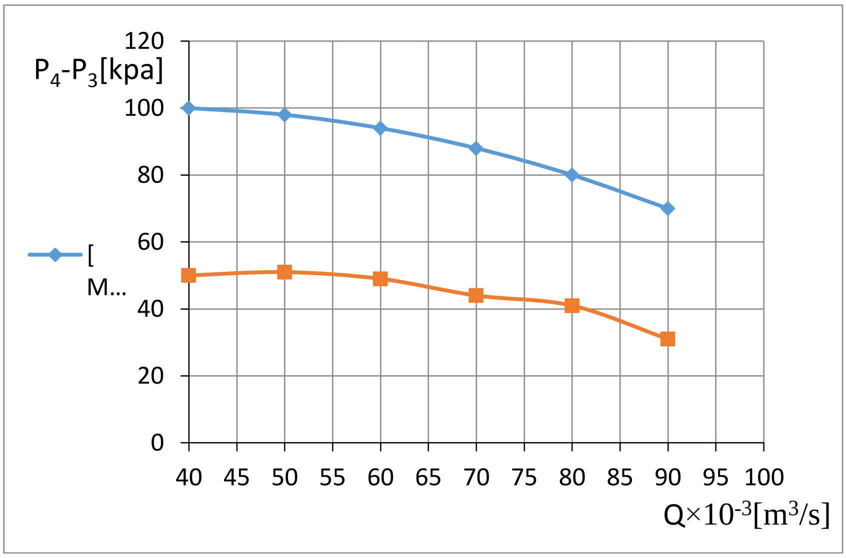

Fig8. Characteristic curve representing the mean increase in static pressure between the inlet and outlet sections (3,4) of vaned diffuser measured and calculated by (3D).

5. Conclusions

The figs (6), (7) presenting the velocities components c_r , c_u there are a good agreement of radial velocities component c_r , between the measurements and calculations with (3D) method, this means the assumed computational model can be used to verify the velocity characteristic of flow in pumps being designed.

There are a small divergences that can be seen in the figs (6), (7) presenting the circumferential components of velocity c_u from the measurements and (3D) calculations.

Fig 8, presents the mean increases in static pressures between the inlet and outlet control planes of the passages of vaned diffuser as a function of pump discharge, in this curve there are a divergences between the results obtained from the measurements and calculated by (3D). This means the assumed calculation model requires further improvements to be applied in (3D) calculations.

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Effects of Cigarette Smoking on Serum Concentration of Lipid profile in male subjects

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Abstract

Smoking problem does not effect on human only, but also on all living organisms in the green plant. In this study, the lipid profile was measured in serum of 75 selected smoking and 25 nonsmoking male subjects. The smokers groups were divided into three subgroups; depending upon intensity of smoking. Each group comprises about 25 volunteers. The Results showed that the levels of total cholesterol, triglyceride, and low density lipoprotein cholesterol (LDL-C) were significantly increased most groups of cigarette smoking comparing to nonsmoking group. While, significant reduction in the level of high density lipoprotein cholesterol (HDL-C) is observed in smoking group as compared to nonsmoking.

Keywords: cholesterol, triglyceride, low density, high density, smoking

INTRODUCTION

Cigarette smoking is one of the most important modifiable risk of variety of medical disorders.[1] Several chemicals exist within tobacco smoke has been estimated about 4800 compounds, including tars, nicotine, carbon monoxide, polycyclic aromatic hydrocarbons and others.[2] The rate and amount of exposure to these chemicals are complex functions of cigarette composition which produce harmful and toxic effects on health including; alternation of lipid profile, increased oxidative LDL-cholesterol, endothelial dysfunction, increased insulin resistance, alternation in fibrinolysis, platelet dysfunction, high blood viscosity, on-going inflammation with increasing inflammatory markers,[3] Moreover, free radicals-mediated oxidative stress appear to play an important role in mediation of athero-thrombotic disease in chronic smokers.[4] Different studies provide the evidence that smoking increases the concentration of serum total cholesterol, triglycerides, LDL-cholesterol, VLDL-cholesterol and decreases the levels of antiatherogenic HDL cholesterol**.**[5,6] Smoking in different forms is a major risk factor for atherosclerosis and coronary heart disease (CHD).[7,8] Smoking is more strongly associated with peripheral arterial disease (PAD) than atherosclerosis in carotid or coronary arteries**.**[9,10] Smoking which is recognized as a major risk factor for the development of ischemic heart disease may lead to alter the normal plasma lipoprotein pattern**.**[11] The mechanism responsible for these association is still unknown exactly, but various mechanisms has been suggested leading to lipid alteration by smoking including: (a) nicotine stimulates sympathetic adrenal system leading to increased secretion of catecholamine resulting in increased lipolysis and increased concentration of plasma free fatty acids (FFA) which further result in increased secretion of hepatic FFAs and hepatic triglycerides along with VLDL- C in the blood stream; (b) Fall in estrogen levels occurs due to smoking which further leads to decreased HDL – cholesterol; (c) Presence of, Hyperinsulinaemia in smokers leads to increased cholesterol, LDL-C, VLDL-C, and TG due to decreased activity of lipoprotein lipase.[12]**.** The present study therefore aimed to evaluate the effects of cigarette smoking on serum lipid profile in male smokers in generally and depending on intensity of smoking.

MATERIALS AND METHODS

Chemicals and instrumentation

Regents: total cholesterol regents, TG, HDL.ch, LDL.ch Kits), were used in the experiment made by Biomaghreb company- Tunisia. Spectrophotometer; Model BTS-302 made in Germany.

Procedure:

Total of 100 volunteers aged between 20-60 years, were divided into two: groups nonsmoking , and cigarette smoking, Group I- Nonsmokers (Control) n=25 - Group II – Cigarette smokers n = 75.

Cigarette smokers (Group –II) were divided into three subgroups depending upon intensity of smoking. Each group contained 25 volunteers. Group II. A -Mild smokers (n =25) (smoking <10 cigarettes / day), Group II. B - Moderate smokers (n=25) (smoking 10-15 cigarettes /day, Group II. C - Heavy smokers (n= 25) (smoking >15 cigarettes/day). The study conducted at Mizda General Hospital, Mizda city, Libya.

After explaining the aims of the study to all of the participants, each subject provided the details about his smoking habits, physical/ physiological, measurements and other information in the form of a standard questionnaire. Age, blood pressure, body weight, body height and other physical measurements were performed. The criteria of the selection of subjects (either smoking or non-smoking) was that no one should have any medical complication such as hypertension, ischemic heart disease, stroke, diabetes or such other disorder. Hence, all male subjects included in the study are the normal healthy conditions. Venous blood samples were collected after 12 hours of an overnight fast into plain and EDTA tubes. Serum or plasma was obtained by low speed centrifugation at 1000g for 15 minute, and samples were immediately separated into aliquot and stored at –20o C until analysis. Cholesterol, Triglyceride, High-density lipoprotein, and Low-density lipoprotein were quantitatively estimated in the serum by enzymatic colorimetric test-CHOD-PAP by commercially available kits.

Statistical analysis

Statistical analysis was performed using the primer for windows McGrow- Hill software. Data were described using the mean (±) standard deviation for the significant difference between groups. ANOVA test was performed of $P \leq 0.05$.

RESULT AND DISCUSSION

Effect of cigarette smoking on lipid profile in male subjects was studied in a group of 75 cigarette smokers compared with 25 non-smoking subjects. The mean ± SD values for serum cholesterol, triglycerides, HDL-ch and LDL-ch are given in (**Table 1 and Table 2**).

Table 1. Lipids profile in smoking and non-smoking subjects in general.

Tests	Non-smoking group (n=25)	Smoking group (n=75)	**P value**
Total cholesterol (mg/dl)	172.26 ± 14.80	194.03 ± 13.30	< 0.05
Triglyceride (mg/dl)	113.13 ± 11.00	175.63 ±19.14	< 0.05
HDL cholesterol (mg/dl)	55.46 ± 5.90	43.9 ± 4.91	< 0.05
LDL-cholesterol (mg/dl)	111.26 ± 15.70	147.13 ± 18.23	< 0.05

Values are expressed as mean ± sd. All p values are in comparison with non-smoking group.

Table 2. Lipids profile in smoking and non-smoking subjects in relation to intensity of smoking.

Tests	Non-smoking	Cigarette smokers		
	Group I (n=25)	Group II A (n=25)	Group II B (n=25)	Group II C(n=25)
Total cholesterol (mg/dl)	172.26 ± 14.80	181.11 ± 17.98 P < 0.05	189.03 ± 20.63 P < 0.05	201.21 ± 24.57 P < 0.05
Triglyceride (mg/dl)	113.13 ± 11.00	169.17 ± 27.57 P < 0.05	176.21 ± 30.54 P < 0.05	179.66 ± 32.44 P < 0.05
HDL cholesterol (mg/dl)	55.46 ± 5.90	46.32 ± 3.50 P < 0.05	42.61 ± 3.16 P < 0.05	38.44 ± 2.84 P < 0.05
LDL-cholesterol (mg/dl)	111.26 ± 15.70	145.22 ± 20.12 P < 0.05	145.92 ± 18.76 P < 0.05	147.33 ± 24.53 P < 0.05

Values are expressed as mean ± sd. All p values are in comparison with non-smoking group.

Results showed that serum level of total cholesterol was significantly increase (P<0.05) in smokers as compared to non-smokers thereby revealing a direct dose response relationship. Previous studies have reported the same findings that smokers have a higher risk lipid profile than non-smokers.[6,12,13]. Higher level of triglycerides was found in smokers groups comparably to control group. Some studies have suggested that, triglyceride levels are the most important factor leading to CHD.[14]. HDL-ch and LDL-ch are useful and important components of lipid transport, and utilization in the body. These parameters were also analyzed. LDL level was also significantly increased in smokers, while the cigarette smoking is associated with reduced HDL-C (anti-atherogenic lipoprotein) level by alteration of the critical enzymes of lipid transport lowering lecithin-cholesterol acyltransferase (LCAT) activity and altering cholesterol ester transfer protein (CETP) and hepatic lipase activity.[15]. Smokers have a higher risk lipid profile than non-smokers.[12,13]**.** Therefore, other studies showed that smoking cessation leads to normal values of HDL-C to be as alike in nonsmokers.[16]

Further information of the effect of intensity of cigarette smoking (number of cigarette per day) on lipid profile was studied. The results show a significant increase in levels of total cholesterol, triglycerides, and LDL-ch in almost all groups of cigarette smokers as compared to nonsmokers. Simultaneously a significant reduction in level of HDL-ch is observed in smoking groups, and a parallel changes in these components with the increase in intensity of cigarette smoking (table 2). The results are in accordance with observation of Afroza *et. al* (2012). The increasing levels of atherogenic lipoproteins notably LDL and IDL (estimated within the non-HDL-C) in association with increased intensity of smoking. These investigations may due to the possible mechanisms which mentioned above.

CONCLUSION

Smoking produces adverse effects on lipid profile, thus increasing the cardiovascular disease risk. Further studies are needed to understand underlying mechanism causing series of changes influenced by smoking.

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Influence of soil texture and equilibrating potassium phosphate on K^+ equilibrium concentration and buffer power

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Abstract
all crops must have enough supplies of all elements throughout the growing season. The amount of nutrients which are available in soil solution should ideally stay at optimum levels in order to be ready to compensate for the nutrients which are up taken by plants during growth stages. However, the availability of nutrients in soil solution is not only dependent on the concentration of ions in soil solution but also on the capacity of a soil to maintain the ion concentration and the ability of soil to buffer its nutrient concentration

Introduction

In general, all crops must have enough supplies of all elements throughout the growing season. The amount of nutrients which are available in soil solution should ideally stay at optimum levels in order to be ready to compensate for the nutrients which are up taken by plants during growth stages. However, the availability of nutrients in soil solution is not only dependent on the concentration of ions in soil solution but also on the capacity of a soil to maintain the ion concentration and the ability of soil to buffer its nutrient concentration (Holford, 1997). More accurate prediction of the effective availability of K^+ to plants can be achieved by incorporating estimates of its buffer characteristics into a soil test program (Nair *et al.*, 1997). The relationship between quantity (Q) and intensity (I) has been defined as buffer power. This relationship is usually used to estimate the supply of potassium from soil to crops and defines the soil's K^+ buffering capacity (Beckett, 1964a; Kumar *et al.*, 2007). The Q / I parametersprovide important information to understand the availability of potassium in the soil, and also can provide valuable indications for potassium fertilisation requirements (Mohsen, 2007). Q refers to K in soil solids and I indicate K^+ concentration in soil solution (Hoang *et al*., 2009). Many researchers have used quantity and intensity parameters for predicting potassium demand in soils (Sparks and Jardine, 1981; Evangelou and Blevins, 1988). Figure 1 describes the typical relationship between Quantity / Intensity in diagrammatic form. The Y-axis refers to the total amount of K in soil solids. A positive value of Δ K means some of the K added has fixed on to the soil (adsorption), whilst negative values mean K is released from soil to solution (desorption). The X-axis refers to the amount of K^+ in soil solution (Holzmueller*et al*., 2007; Hoang *et al*., 2009). Fig1 shows the relationship between Δ K and the K activity ratio (AR)where;

$AR = K_{eq} / ([Ca]_{eq} + [Mg]_{eq})^{1/2}$

and

$\Delta K = ([K]_0 - [K]_{eq}) V/W$

where $[Ca]_{eq}$, $[Mg]_{eq}$and $[K]_{eq}$ represent the calcium, magnesium and potassium concentrations in soil solution after soil shaking (equilibration), whilst K_0 is the potassium concentration prior to shaking in solution, V refers to quantity of solution added to soil and W means dry weight of soil. In practice, the curve is derived by statistically fitting a suitable model to empirical data.

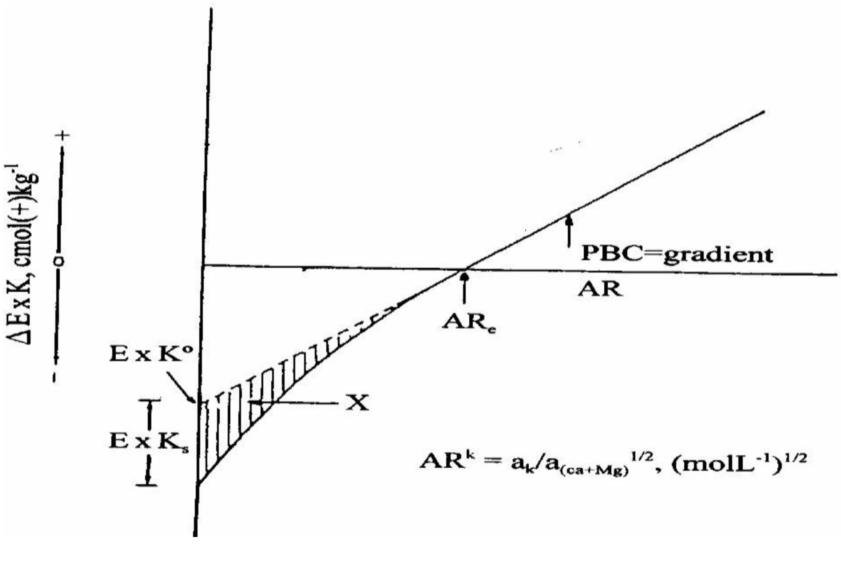

Fig 1.A typical Q/I plot (Beckett and Nafady, 1967). AR, Activity ratio; I, intensity; E x K, quantity (Q); E x K°, labile K; ARe, equilibrium activity ratio; E x Ks; potassium specific adsorption; PBC, potential buffering capacity; cmol (+) kg^{-1}, ion equivalent kg^{-1} soil.*Source yong (2010).

The value of the intercept point with the Y-axis is the non-specific absorption of potassium (Sinclair, 1979; Jalali, 2007). The intersection point of the curve with the Y-axis refers to the value for exchangeable potassium (Kex) (Evangelou and Karathanasis, 1986). Other important parameters can be obtained from the Q / I diagram such as: Equilibrium concentration of potassium (Keq) or activity ratio which is where the line intersects the X axis, and refers to the potassium absorption or intensity of K^+ in the soil solution that is available for uptake by crops from the soil directly. Secondly, the potential buffering capacity refers tothe capacity of the soil for maintaining the intensity of K^+ in the soil solution. The gradient of the Q / I curve at the point of intersection with the X axis is the buffer power (Knibb and Thomas, 1972)

High values of buffer power indicate the potential availability of large amounts of potassium over a long time period, whilst when buffer power is low it indicates that K fertiliser will be required to meet a crop's K demands. Taiow*et al.* (2010) studied twelve surface soils and found that approximately 50% of the soils which were examined in the field or in the greenhouse had high potential buffer capacity and this indicated that potassium is released slowly from soil solution.

Information about K^+ buffering characteristics can be useful when making recommendations about K fertiliser applications to crops. However, the relationship between the PBC and the requirement for potassium fertilisers depends on the kind of the plants. For example, bananas rape and peanuts required high application of potassium fertiliser (Yong, 2010). But in general, K fertilisation depends on the buffer capacity value. If the buffer capacity is high then K fertiliser can be applied once with a large amount while if there is low buffer capacity then K fertiliser should be added several times to ensure the activity ratio is maintained at a higher and more stable value. Thus, both K^+ equilibrium concentration and K^+ buffer power are considered to be very important factors that predict amounts of available potassium in the soil. Thus, soil buffer power is affected by many factors, the most important of which is the soil properties (texture, CEC, and organic matter).

Rationale

K^+ availability to plants depends on its equilibrium concentration in the soil solution and the soil's buffer power. These properties are measured by equilibrating soils with solution of known K^+ concentration and determining the change in K^+ concentration caused by ion exchange. However, as explained above, it is not known how such measurements are affected by potassiumphosphate used nor if the texture of the soil (which will be related to its ion exchange capacity) is important. Therefore, the experiment aimed to address this relations.

Hypotheses

Soil texture and equilibrating potassium phosphate influences K^+ equilibrium concentration in soil solution and soil K^+ buffer power.

Materials and methods

Three different soil textures were used to estimatedK^+ equilibrium concentration in soil solution and soil K^+ buffer power. All samples were air-dried at 25 ^oC. Soil samples were collected from three different agricultural areas. These samples were different in their texture (Silty Clay Loam- Loamy Sand – Sandy Loam)

All soil samples were treated with six concentrations of potassium phosphate salt. The salt concentrations were 0, 0.5, 1, 2, 3, and 5 mM K^+ in 10 mM $CaCl_2$. The salt which used for the experiment was potassium phosphate, (KH_2PO_4). Three replicates were analyzed. This salt was used to evaluate the response of K^+ buffer power and K^+ equilibrium in the soils to K salts. 25 ml of solution were added to 5 g of air-dried soil in a conical flask. The soil suspensions were shaken for 2 hours and left to stand 2 hours before filtering through Whatman 41 paper.

The K equilibrium concentration and K^+ buffer power were estimated by fitting a quadratic equation to the data using least-squares non-linear regression (Microsoft Excel). The quadratic equation is

$y = cx^2 + bx + a$.

where x is the K^+ concentration in the added solution and y is the exchangeable K^+ measured after equilibrating the soil with the potassium salts. The K^+ equilibrium concentration is defined as the value of x at which y is zero, i.e., the K^+ concentration that balances K^+ adsorption and desorption. For a quadratic equation, the value of x when y = 0 is given by $x = [-b \pm \text{sqrt}(b^2-4ac)]/2c$. The K^+ buffer power is defined as the gradient of the curve when y = 0. For a quadratic equation, the gradient is given by $2cx + b$
where x is the K^+ equilibrium concentration. A quadratic equation was used because, unlike a linear equation, it allows for the possibility of saturation of K^+ sorption as the K^+ concentration of the equilibrating solution increases.

Effects of soil type and equilibrating salt on K^+ equilibrium concentrations and K^+ buffer power were tested using analysis of variance (two-way general linear models) in Minitab. Where residuals of data were not normally distributed, data were log-transformed where appropriate.

Results

The greater the K^+ concentration of the added solution, the more K^+ remained in solution after equilibration with each soil (Table1).The K^+ concentrations shown in Table 1 were used to construct K^+ sorption isotherms, from which equilibrium K^+ concentrations and buffer powers were derived.

Table 1. Mean concentrations of K^+ remaining in solution after equilibrating soils with potassium phosphate salt. K^+ conc. is the initial K^+ concentration of the equilibrating solution after equilibration.

conc.	Sandy Loam	Loamy Sand	Silty Clay Loam
mmol l^{-1}	KH_2PO_4 cmol kg^{-1}	KH_2PO_4 cmol kg^{-1}	KH_2PO_4 cmol kg^{-1}
0 ±SE	-0.06 0.01	-0.10 0.1	-0.17 0.06
0.5 ±SE	0.03 0.03	0.10 0.01	0.10 0.02
1 ±SE	0.13 0.03	0.33 0.03	0.30 0.02

2 ±SE	0.37 0.07	0.60 0.01	0.73 0.03
3 ±SE	0.83 0.03	1.03 0.13	1.17 0.03
5 ±SE	1.37 0.03	1.67 0.03	2.03 0.03

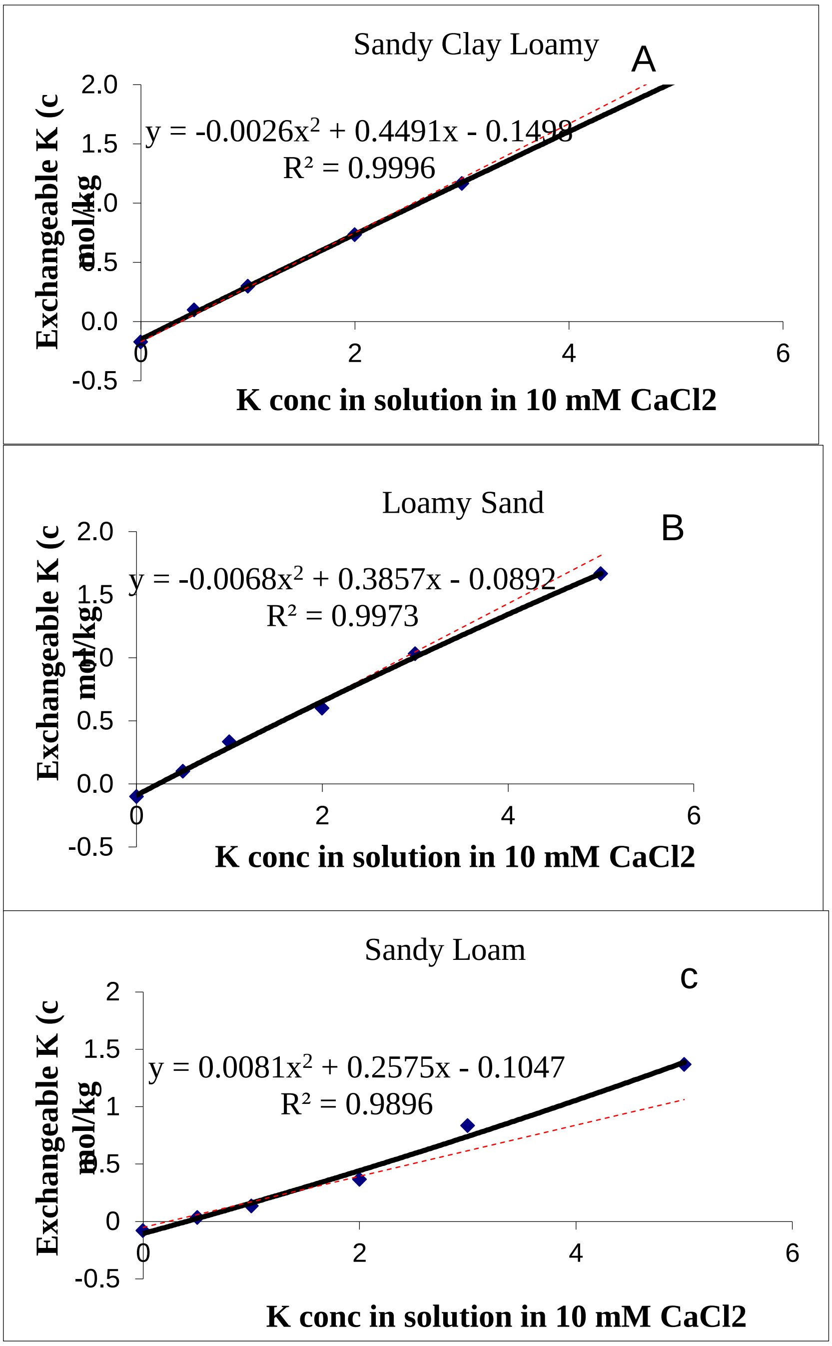

Fig 2 (A, B and C). The effect of different concentrations of KH_2PO_4 on potassium equilibrium concentration (Keq) and buffer power

(KBF) in three different soil textures. Symbols are means of three replicates. The bold curve is the quadratic function fitted to the data. Keq is defined as the value of x when y = 0. The broken line is the tangent to the quadratic curve when y = 0 and its slope at that point = KBP.

Analyses of variance showed that both equilibrating K^+ salt and soil type had significant effects on K^+ equilibrium concentration and K^+ buffer power ($P < 0.005$). Statistical interactions between soil type and salt were non-significant ($P > 0.05$).

The mean values of equilibrium concentration and buffer power derived from the sorption isotherms are summarised in Table 2.

Table 2. Mean (± SE) equilibrium potassium concentrations and buffer powers (*n* = 3). Means in the same column followed by different letters are statistically different at P = 0.05.

Soil	Salt	Equilibrium potassium mM	Buffer power cmol kg^{-1} $(mM)^{-1}$
Sandy Loam	KH_2PO_4 ±SE	0.24 a b 0.04	0.22 a 0.02
Loamy Sand	KH_2PO_4 ±SE	0.28 a 0.03	0.38 a 0.05
Silty Clay Loam	KH_2PO_4 ±SE	0.36 b 0.01	0.46 b 0.03

The results of statistical analysis (GLM Table) showed that all three soils had significant effects on K^+ buffer power when equilibrated with KH_2PO_4 ($P < 0.002$), however, KBP in Sandy Loam andLoamy Sand soils did not show significant effect when they equilibrated with KH_2PO_4. where the greatest value of Keq was obtained in Silty Clay Loam soil 0.36 mM followed by 0.28 mM in theSandy Loam soil and the least was 024 mMin Loamy Sand soil. Potassium phosphate had highly significant influence on KBP; this significant effect was obviously in Silty Clay Loam soil. Furthermore, the mean values of all soils involved in the trial exhibited variations in soil K buffer power (Table 2). They ranged from 0.22 to 0.46 cmol kg^{-1} $(mM)^{-1}$. The greatest value of soil K buffer power was recorded in the Silty Clay Lam soil followed byLoamy Sand soil 0.38 cmol kg^{-1} $(mM)^{-1}$ and the lowest value was observed in sandy Loam soil.

In general, all soils and potassium salt had a highly significant effect on both K^+ equilibrium concentration and K^+ buffer power. There was positive correlation between exchangeable K^+ and K^+ concentration in soil solution in all soils resulting from potassium salt application where R^2 in all curves were at least 0.97. For example, salt had a larger effect than soil on K^+ equilibrium concentration.These results confirmed the hypothesis that is soil texture has directed an effect on both K equilibrium concentration and soil K^+ buffer power, where the values of K^+ equilibrium concentration and soil K buffer power were different from one soil to other.This experiment has demonstrated that estimating the K^+ sorption properties of soils was influenced by both soil type and the K^+ salt used in the equilibration procedure. Therefore, the hypotheses were supported by the results. Equilibration with KH_2PO_4 usually produced the highest estimates of K^+ buffer power. The heavier textured Silty Clay Loam soil generally had a higher equilibrium K^+ concentration and K^+ buffer power than the lighter soils from Sandy Loam and Loamy Sand soils. Possible reasons for these influences will now be discussed.Results were recorded by Jimene and Parra (1991) and Mittal *et al*. (1987) who reported that a positive correlation was obtained between buffer power and clay content. But this does not include a wide range of soils (Rao and Sekhon, 1989). Thus, potassium buffer power cannot be estimated by clay contents only but it is also related to different type of clay minerals such as smectitic group (Yong, 2010). Also, K^+ buffer power is determined by CEC (Mittal *et al*., 1987). Pal Yash *et al*. (1996) confirmed in their experiments which were conducted on different soil textures that a higher buffer power was observed in clay soils.

The lowest mean value of K^+ equilibrium concentration and buffer power were recorded in sandy soils.Similar results were reported by Schneider (2003) who reported that light soils had very low buffer power, while heavy soils with high clay content were much more highly buffered. Postel (1990) tested 20 different soil textures to estimate the K supplying power of soils and concluded that lowest K^+ buffer power was in sandy soils due to high susceptibility to potassium leaching. Also,these results agree with Abbas (2006) who found that soils which had high buffer power contained clay minerals in their texture and on the converse is true in sandy soils where buffer power was very low. In this case, soils which have high buffer power is quickly replenished when the nutrient is absorbed from soil solution

(Nair,1996) or have sufficient K^+ in reserve to compensate for K^+ used by plants whilst soils of low buffer capacity will replace used K^+ slowly (Taiwo *et al*., 2010).

Because the soils used in this experiment were collected from different locations (in order to obtain samples with contrasting textures), they could also have been subjected to different management histories, in particular, fertiliser applications. Thereby, different management histories especially fertiliser application could have influenced the experimental results. For example, results showed the mean of K^+ equilibrium values in Sandy Loam soil is higher than Loamy Sand soil in spite of the Loamy Sandsoil containing more clay minerals in their texture than Sandy Loam. In this case increased K^+ equilibrium could be attributed to historical fertilisation or possibly this soil received more plant residues. Crop residues (organic matter) enhance the soil cation exchange capacity thereby increase the ability of soil to hold nutrients such as potassium, calcium and magnesium (Newman *et al*., 2007).

Increased potassium concentration in soil solution at all three soils by increasing the level of potassium salt; this could be attributed to shortage of potassium in the soil solution. Similar results were recorded by Ganeshamurthy and Biswas (1983) who found that increases in the value of potassium activity ratio (K^+ concentration) when K fertiliser is increased irrespective of type of K fertiliser,and decrease of K^+ concentrations when treatments did not receive K fertiliser. However, the mean value of K^+ equilibrium concentration and K^+ buffer power in soil solution was different between soils, and its depending on soil texture and type of potassium salts.

Conclusions.

1. the hypotheses was supported by the results of the experiment.
2. Soils of different texture have different K^+ sorption characteristics when these are determined under standardised conditions.
3. But equilibrating K^+ salt also matters to determine K^+ sorption isotherm where Keq and KBP depend on salt type.

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