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المجلة العلمية لجامعة الملك فيصل - المجلد الخامس - العدد الأول

ب العلوم الأساسية والتطبيقية

المجلة العلمية
لجامعة الملك فيصل

(العلوم الأساسية والتطبيقية)

مجلة علمية محكمة

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القسم العربي

القسم الإنجليزي

دراسة بتروغرافية جيوكيميائية للحشوات القاعدية و فوق القاعدية المرافقة للصخور البازلتية القلوية الرباعية لحقل شامة البركاني "جنوب غرب سوريا"

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الملخص :

يترافق مع البازلت القلوي العائد لعصري النيوجين والرباعي والمنتشر في الجزء الشمالي الشرقي لحقل شامة البركاني (جنوب غرب سوريا) كمية كبيرة من الحشوات ذات التراكيب القاعدية وفوق القاعدية (Xenoliths) إضافة للبلورات الفلزية النامية الكبيرة (Megacrysts) ، و تعود أهمية دراسة هذه الحشوات أنها تسهم في معرفة طبيعة ليتوسفير الجزء الشمالي للصفيحة العربية (سوريا).

أظهرت الدراسة البتروغرافية و الجيوكيميائية للحشوات تنوعاً بترولوجياً كبيراً أظهر معه شروط توازن لأوساط تشكل متباينة تعود إما للجزء السفلي من القشرة الأرضية أو للجزء العلوي من المعطف الأرضي، كما دلت دراسة المجموع الفلزي للحشوات وكذلك اختبار بعض الجيوتيرموباروميترات على شروط توازن لحشوات الجزء العلوي من المعطف الأرضي الليرزوليتية و البيروكسينيتية والتي تتراوح بين 13.5 -14.5 كيلوبار للضغط و 950 -1060 م^{o} للحرارة ، أما شروط تشكل حشوات الجزء السفلي للقشرة الأرضية الغابروئيدية فتتراوح بين 6 - 8 كيلو بار للضغط و 850 -920 م^{o} للحرارة .

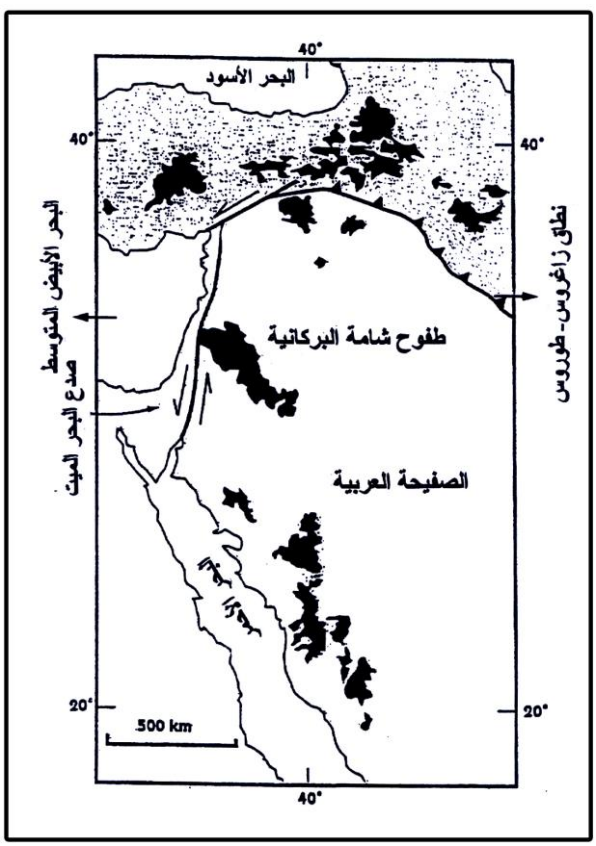
مقدمة و هدف البحث :

تعتبر دراسة الحشوات المتشكلة في الجزء السفلي للقشرة الأرضية و الجزء العلوي من المعطف الأرضي من المواضيع الهامة التي شغلت الكثير من العلماء والباحثين وأصبحت موضع اهتمامهم بسبب مساهمة هذه الحشوات في تقديم صورة واضحة حول طبيعة أسفل القشرة الأرضية والمعطف العلوي ، حيث قدمت الدراسة الدقيقة البتروغرافية - الجيوكيميائية و البترولوجية للحشوات معلومات هامة حول طبيعة الليتوسفير و شكل تطور المادة المهلية البازلتية التركيب المتشكلة في المعطف ، كما يمكن أن تقدم أدلة حقيقية مباشرة لتركيب الجزء السفلي للقشرة الأرضية وللجزء العلوي للمعطف الأرضي . إن معرفة مجمل هذه التراكيب هو أمر ضروري لفهم الظواهر و البنيات الجيولوجية ذات المقياس الإقليمي الكبير.

تمتد الانسكابات و الصبات البركانية البازلتية القلوية التركيب الثلاثية والرباعية العمر (Harrats) الحرات في الصفيحة العربية مسافة 2800 كم (McGuire,1988 a ; b) من اليمن جنوباً عبر المملكة العربية السعودية فالأردن ثم سوريا وتركيا شمالاً (شكل – 1) ، هذا و يرتبط النشاط البركاني في المنطقة بحركة الصفيحة العربية التي تسببت بتشكل الانهدامات الإقليمية لا سيما انهدام البحر الأحمر والصدع التحولي المشرقي الممتد من خليج العقبة جنوباً حتى جبال الأمانوس شمالاً (Dutria and Girod,1987).

تحتل الانسكابات البركانية البازلتية القلوية مساحة تقارب الـ 180000كم^2 (Coleman et al.1983) ، و يعتبر إقليم حرات الشام المتمركز في الجزء الشمالي الغربي للصفيحة العربية من أكبر الاندفاعات البركانية القلوية انتشارا والممتد من جنوب غرب سوريا (منخفض جبل العرب) عبر الأردن (منطقة الأزرق) حتى (وادي سرحان) في شمال غرب المملكة العربية السعودية، وتبلغ مساحته حوالي الـ

50000كم^2. هذا و يعتبر منخفض جبل العرب الجزء الأهم لهذا الإقليم ومنطقة تراكم رئيسة للانسكابات البازلتية حيث تتراوح سماكتها في الجزء المركزي من المنخفض بين 1 -1.5كم. كما وتقدر البراكين التي ساهمت في تشكيل هذه التوضعات البازلتية بأربعمائة بركان (Ponikarov,1962) تنتشر على طول كسور فالقية عميقة ذات اتجاه شمال غرب – جنوب شرق (Quennell,1996).



شكل (1) : يبين توزع أهم الانسكابات و الصبات البركانية السينوزوية في الصفيحة العربية ، مأخوذة من (Medaris and Syada,1999).

بين (Camp and Roobol,1992) أن بداية النشاط البركاني في منطقة جبل العرب تعود إلى 32 مليون سنة أي للعصر الميوسيني الأوسط والذي استمر حتى بداية التأريخ الإنساني الحالي، كما بينت بعض الدراسات مثل: (Camp et al.,1991) ; (McGuire,1988 a ; b) أن أغلب الانسكابات البركانية البازلتية تدفقت خلال العشرة ملايين سنة الأخيرة.

أشارت عمليات المسح الجيولوجي للانسكابات البركانية البازلتية القلوية التركيب المنتشرة ضمن الصفيحة العربية إلى ترافق عدد كبير من براكينها مع الحشوات و الميغاكريست (Nasir and Al-Fuqha, 1988); (McGuire, 1988a;b); (Abu Al-Jarayesh *et al.*, 1993); (Coleman *et al.* 1983); (Nasir and Safarjalani, 2000); (Nasir and Safarjalani, 1995); (Nasir *et al.*, 1992) قام عدد من الباحثين بدراسة مفصلة للحشوات المرافقة للصخور البازلتية المنتشرة في المملكة العربية السعودية والأردن (McGuire,1988 a; b) ; (Nasir,1990 ;1992;1994;1995) ; (Henjes- Knust et al.,1990) (Nasir et al.,1993) ; (Nasir and Mahmood,1991). في حين أنه لم يكن هناك إلا دراسات محدودة في سوريا نذكر منها: ; (Medaris and Syada,1998;1999) ; (Safarjalani and Nasir,1996) ; (Syada et al.,1996) ; (Snyder et al.,1995) ; (Turkmani et al.,1996).

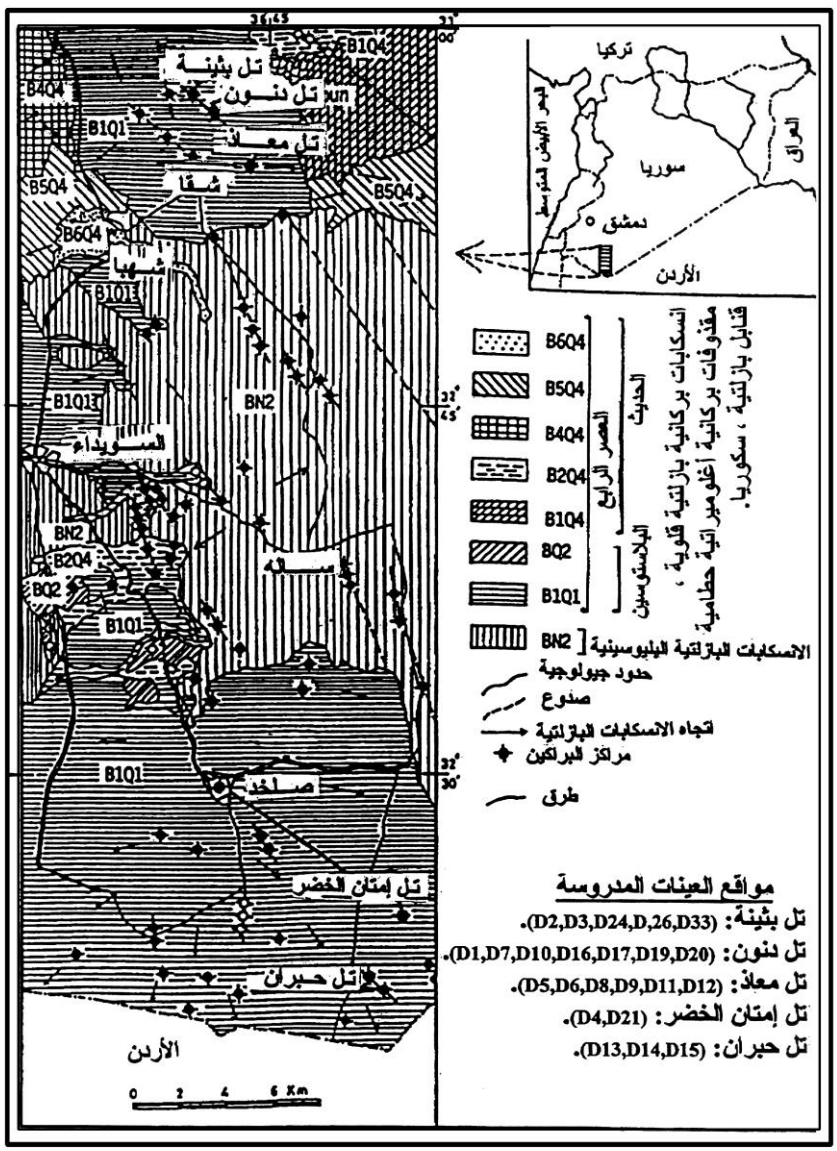
حددت عمليات المسح الجيولوجي لمنطقة جبل العرب ; (Syada et al.,1996) (Turkmani et al.,1996) ثلاثة و عشرون موقعاً بركانياً يحتوي على تنوعاً كبيرًا من الحشوات المقتلعة من الجزء السفلي من القشرة أو من الجزء العلوي للمعطف الأرضي والميغاكريست مثل:" تل دنون - تل بثينة - تل فأرة - تل معاذ - تل الخالدية - تل الأشاعر - تل خنفة - تل قليب - تل العراجي - تل أحمر - صلخد – تل خضر إمتان - تل العجيلات - تل حبران". و يتواجد أغلبها برفقة الصخور البازلتية القلوية حديثة العمر< 5 مليون سنة (Medaris and Syada,1999).

تمثل هذه الورقة نتائج الدراسة البتروغرافية و الجيوكيميائية لمجموعة من الحشوات المتشكلة في الجزء السفلي للقشرة الأرضية وتلك المتشكلة في الجزء العلوي من المعطف الأرضي والمرافقة للبازلت القلوي العائد للعصر الرباعي والمتكشف في كل من تل دنون، تل بثينة، تل معاذ، تل خضر إمتان و تل حبران من المنطقة الجنوبية الغربية لسوريا (شكل -2).

جيولوجية المنطقة :

تقع سوريا في الجزء الشمالي الغربي للصفيحة العربية و تقسم إلى مجموعة من الوحدات البنيوية - التكتونية الرئيسة التالية: يقع في الجزء الجنوبي الغربي لسوريا منخفض جبل العرب الذي يمتلئ ببازلت النيوجين والرباعي و في الشمال نجد نهوض هضبة حلب وفي الجنوب الشرقي نهوض الرطبة و في أواسط البلاد يمكن تمييز حزام الطي التدمري وفي الشمال الشرقي منخفض الفرات بينما يتواجد حزام الطي التدمري الإنغراسي ضمن القاري محشوراً بين نهوض هضبة حلب في الشمال ونهوض الرطبة في الجنوب متحداً مع نظام فالق البحر الميت في الاتجاه الجنوبي الغربي و ينتهي قرب منخفض الفرات في الاتجاه الشمالي الشرقي (Seber et al.1993).

تم تقسيم بازلت الجزء الجنوبي لسورية إلى أربعة وحدات بركانية منفصلة: ميوسينيه - بليوسينيه و رباعية مع أنها لا تختلف كثيراً في الخصائص البتروكيميائية و البتروغرافية (Ponikarov,1962)، هذا و تغطي الانسكابات البازلتية كل من الصخور الرسوبية الكريتاسية - الثلاثية و الرباعية (Mouty et al.,1992) .



شكل 2 : خارطة جيولوجية تبين مواقع العينات المدروسة

يرجع كل من (Poinkarov,1967); (Barberi et al.,1980); (Camp and Roobol, 1989)الحدث البركاني في سوريا غالباً إلى طورين كما هو الحال تماماً لمظاهر البركنة المشاهدة في باقي أجزاء المنطقة مثل الأردن ، فلسطين ، و المملكة العربية السعودية . يمتد الطور الأول في الفترة الواقعة بين 24 -16 مليون سنة، بينما يمتد الطور الثاني بين 0.4 - 8 مليون سنة (Capan et al.,1987).

تترافق معظم الصبات الثلاثية والرباعية مع تنوع كبير ومتباين من الحشوات ذات التركيب القاعدي وفوق القاعدي والتي تعود بتشكلها إما إلى الجزء العلوي من المعطف أو للجزء السفلي للقشرة الأرضية (Turkmani et al.,1996) وتمثل الصخور المهلية المضيفة لهذه الحشوات صخوراً بازلتية أوليفينية إلى بازلتية قلوية الطبيعة (Mouty, et al.,1992).

المواد و طرائق البحث:

تم جمع 150 عينة حشوة اشتملت على 120 حشوة فوق قاعدية ليرزوليتية بيروكسينيتية التركيب و 30 حشوة قاعدية غابروئيدية التركيب من المواقع البركانية الخمسة المدروسة (شكل – 2) ، اختير منها 23 حشوة غير متحللة أو متأكسدة (طازجة) خصصت للدراستين البتروغرافية و الجيوكيميائية.

أنجزت الدراسة البتروغرافية باستخدام المجهر الاستقطابي الموصول مباشرة بجهاز التعداد الفلزي المخصص لحساب التركيب الفلزي الحقيقي (Modal analyses) وذلك باتباع طريقة العد النقطي"تم تحديد المسافة بين نقطة و أخرى حسب الأبعاد الوسطية للحبيبات الفلزية لكل عينة".

تم تحليل المكونات الفلزية الرئيسة بتقنية مجهر المسح الإلكتروني (الميكروبروب - نوع SU-30) وباستخدام طريقة الموجات الطولية المشتتة (في قسم الأراضي و علوم

البيئة التابع لجامعة اليرموك – الأردن)، بلغ زمن التحليل الكلي 10ثانية لكل قياس نقطي باستعمال تيار كهربائي توتره 18 كيلوفولط وشدته 10 نانوأمبير ، كما أجريت على كافة نتائج التحليل تصحيحات وذلك باستخدام برنامج (ZAF) ، تمثل كل نتيجة تحليل متوسط ثلاثة نتائج قياس تحليل نقطية على الأقل.

تم تحديد المحتوى الكلي للحشوات من العناصر الكيميائية الرئيسة و الشحيحة بواسطة تقنية جهاز الأشعة السينية (XRF) باستثناء عنصر Na فقد تم تقديره بواسطة جهاز الامتصاص الذري (AAS) . حددت نسبة بعض العناصر النادرة بواسطة جهاز مقياس الكتلة الذري يعمل بواسطة البلازما المحرضة (ARL - 3410, ICP - MS) التابع لهيئة الموارد الطبيعية في الأردن. تم تحليل ثلاث عينات معيارية مرجعية أخذت من هيئة المساحة الجيولوجية الأمريكية من أجل التأكد من نتائج التحليل ، وقد تراوحت دقة التحليل للعناصر الكيميائية الرئيسة و الشحيحة بين 6 -4 ٪.

الدراسة البتروغرافية للحشوات :

تتواجد الحشوات الصخرية القاعدية و فوق القاعدية في أغلب الأطوار البركانية خاصة الأغلوميراتية منها و تنتشر على جوانب القمم و التلال البركانية ومنحدراتها وتأخذ معظم الحشوات أشكالاً شبه كروية إلى بيضاوية متطاولة ، زاوية مسطحة أو غير منتظمة ، متآكلة الحواف غالباً و تتروح أقطارها بين 2 - 30 سم. لوحظ وجود علاقة بين أبعاد مقاييس الحشوات و درجة تفاضلها ، فالحشوات الليرزوليتية هي الأكبر وتصل أقطارها إلى 25 سم بينما لا تزيد أبعاد الحشوات البيروكسينيتية عن 8 سم .

تشاهد الحشوات حرة سائبة أو مغلفة بطبقة رقيقة من البازلت ، أو تشكل أحياناً نوى للقنابل البازلتية . تتميز الحشوات عموما بنسيج كتلي إلا أنها تبدي تنوعاً وتبايناً في بنياتها فبعضها يتميز ببنية نارية أولية أو متساوية الحبيبية والأخر يتميز ببنية

بورفيرية إلى بورفيروكلاستية. تمثل الحشوات المنتشرة في المنطقة أنواعاً متباينة ، قُسِّمت اعتمادا على محتواها الفلزي أو بنيتها و نسيجها إلى خمسة مجموعات رئيسة هي:

- مجموعة الديوبسيد الكرومي الليرزوليتي : حسب تصنيف (Wilshair and Shervais,1975) و تقابل المجموعة I حسب (Frey and Prinz,1978) ، تتراوح نسبة تواجد حشوات هذه المجموعة بين 65 – 70٪ ، يحتوي معظمها على فلز الفلوغوبيت أولي أو ثانوي التشكل مع أو بدون ترافق لفلز الهورنبلند وتتميز ببنية بروتوغرانولية (حبيبي أولي) إلى إيكوغرانولية. تتألف حشوات هذه المجموعة من الفلزات الرئيسة التالية : أوليفين - كلينوبيروكسين - أورثو بيروكسين - سبينيل بني (بيكوتيت) و ينتمي إليها الدونيت ، الليرزوليت ، الهارتزبورجيت و الويرليت.
- مجموعة الأوجيت الألوميني - التيتاني : حسب تصنيف (Wilshair and Shervais,1975) و تقابل المجموعة II حسب (Frey and Prinz,1978) ، تتغير نسبة تواجد حشوات هذه المجموعة بالنسبة للمجموعات الأخرى وتشكل وسطياً نسبة 25٪ ، . ينتمي لهذه المجموعة حشوات الويبستريت و البيروكسينيت وتتميز عادة بترافقها مع فلز السبينيل الأسود أو الأخضر (الهرسينيت) وأحياناً فلز الغارنت.
- مجموعة الميتابيروكسينيت : ينتمي إلى هذه المجموعة الحشوات من نوع سبينيل بيروكسينيت و الغارنت بيروكسينيت و تتميز هذه المجموعة عادة بنسيج اندفاعي ، تحتوي على فلز السبينيل كما تتميز بوجود ظواهر فجوات انحلالية لفلز الغارنت أو بعمليات انحلال فلز الأورثوبيروكسين ضمن فلز الكلينوبيروكسين وتشكيل شرائط انحلال .

- مجموعة البلورات الكبيرة (الميغاكريست) : تتميز هذه المجموعة غالباً بافتقارها للكروم و تضم كل من فلز الغارنت من نوع البيروب، الأوجيت، الكيرسوتيت، الإيلمينيت، السبينيل والأوليفين.
- مجموعة حشوات أسفل القشرة : تضم هذه المجموعة حشوات الغرانوليت البيروكسيني و حشوات مجموعة الغابرو و الدولوريت ، تتراوح نسبة تواجد حشوات هذه المجموعة بين 5 -8٪.

يبين الجدول (1) المحتوى الفلزي الحقيقي للعينات المدروسة ، ويظهر أن هذه العينات تعود لثلاثة أنماط حشوية متباينة من حيث التركيب الفلزي والطبيعة والخصائص و التي تعكس ظروف منشئيه مختلفة.

بتروغرافيا حشوات المعطف العلوي (حشوات البيريدوتيت السبينيلي و حشوات البيروكسينيت):

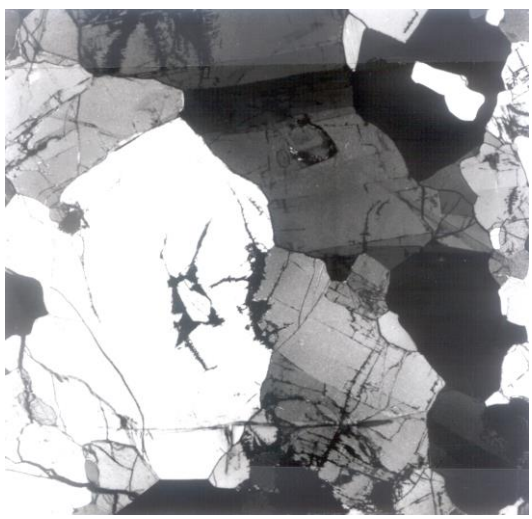
تتميز حشوات البيريدوتيت السبينيلي ببنيات أولية بروتوغرانولارية و أحياناً نارية أولية أو متساوية الحبيبية (شكل - 3و 4) ، بينما تمتلك الحشوات البيروكسينيتية نوعين من البنيات هما : البورفيروكلاستية و هي الأكثر شيوعاً و تبدي فيها جميع الحبيبات الفلزية تشوهات بدرجات متفاوتة و البنية الغرانولارية الحبيبية و هي الأقل انتشاراً (شكل -5). تتألف حشوات المعطف العلوي بشكل رئيس من الفلزات الرئيسة التالية: الأوليفين ، الكلينو بيروكسين (البيروكسين المائل) و الأورثوبيروكسين (البيروكسين المستقيم) إضافة إلى السبينيل والفلوغوبيت والهورنبلند كفلزات ثانوية.

جدول (1)

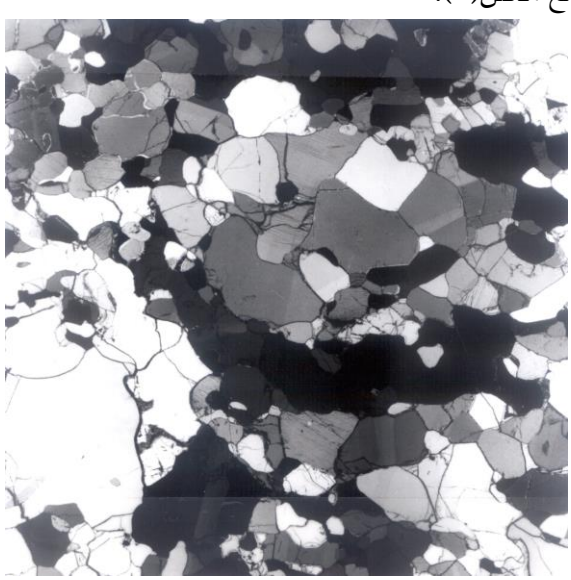
التركيب الفلزي العياري للحشوات الصخرية القاعدية وفوق القاعدية المدروسة

Samp	Loca.	Typ.	Texture	Oli.	CPx.	Opx.	Spl.	Gar.	Plag.	Phl.+hbl	Mag.
D01	تل دنون	Pyx.	Porph.	28	60	08	02	02	-	+	+
D02	تل بثينة	Pyx.	Porph.	35	55	06	+	04	-	+	+
D03	تل بثينة	Pyx.	Porph.	16	67	03	10	+	-	04	+
D04	تل امتان	Pyx.	Porph.	26	69	02	+	+	-	03	+
D05	تل معاذ	Pyx.	Igneo.	40	54	03	+	03	-	+	+
D06	تل معاذ	Pyx.	Igneo.	30	55	10	+	03	-	+	02
D07	تل دنون	Pyx.	Porph.	65	24	05	04	+	-	+	+
D11	تل معاذ	Pyx.	Porph.	43	50	05	02	+	-	02	+
D12	تل معاذ	Pyx.	Porph.	32	58	06	02	-	-	-	02
D08	تل معاذ	Lhz.	Equig.	65	06	26	03	-	-	-	+
D09	تل معاذ	Lhz.	Equig.	68	05	25	02	-	-	-	+
D10	تل دنون	Lhz.	Equig.	55	13	28	04	-	-	-	+
D13	تل حبران	Lhz.	Protog.	55	17	18	02	-	-	06	02
D14	تل حبران	Lhz.	Protog.	58	20	18	03	-	-	+	01
D15	تل حبران	Lhz.	Protog.	50	25	20	05	-	-	-	+
D16	تل دنون	Lhz.	Protog.	55	18	18	04	-	-	02	03
D17	تل دنون	Lhz.	Protog.	54	06	37	02	-	-	01	+
D21	تل امتان	Lhz.	Protog.	66	14	13	03	-	-	02	02
D19	تل دنون	Lcx.	Equig.	-	40	17	-	-	40	+	03
D20	تل دنون	Lcx.	Equig.	-	40	15	+	-	42	+	03
D24	تل بثينة	Lcx.	Equig.	-	30	12	+	-	55	+	03
D26	تل بثينة	Lcx.	Equig.	-	15	20	-	-	60	+	05
D33	تل بثينة	Lcx.	Equig.	-	35	15	+	-	48	+	02

Samp. : العينة ، Loca : الموقع ، Typ. : المجموعة ، Pyx. :حشوات البيروكسينيت ، Lhz. :حشوات الليرزوليت ، Lcx. :حشوات أسفل القشرة الأرضية ، Oli. : أوليفين ، CPx. : كلينوبيروكسين ، Opx. : أورثوبيروكسين ، Spl. : سبينيل ، Gar. : غارنت ، Phl. : فلوغوبيت ، Hbl. : هورنبلند ، Mag. : ماغنيتيت ، Text. :النسيج ، (+) <0.3٪



شكل 3 : حشوة ليرزوليت سبينيلي ، بنية متساوية الحبيبية ، عينة D-9 ، تكبير X8 ، مع محلل(+).



شكل 4 : حشوة ليرزوليت سبينيلي ، بنية متساوية الحبيبية ، عينة D-10 ، تكبير X8 ، مع محلل(+)

يظهر فلز الأوليفين في حشوات البيريدوتيت السبينيلي على شكل بلورات وجهيه إلى تحت وجهيه قليل الفساد و تتراوح أقطار حبيباته بين 2-5 مم و نسبته بين 54 - 68٪ ويشكل وسطياً 58٪ كما تتروح نسبة الفورستريت به بين 85 - 92٪ ، تتناقص نسبة تواجد الأوليفين في الحشوات البيروكسينيتية حيث تتراوح بين 16 - 65٪ ويشكل وسطياً 35٪ كما أن نسبة الفورستريت تتراوح به بين 74 - 90٪ .

تتباين نسب تواجد كل من فلزي الكلينو بيروكسين و الأورثوبيروكسين وذلك تبعاً للنمط البتر ولوجي للحشوة وبشكل عام تتواجد حبيبات فلز الكلينو بيروكسين الخضراء الباهته على هيئة بلورات تحت وجهية غير متحللة تبدي تعدد لوني ضعيف يتراوح من الأخضر الشاحب إلى عديم اللون ، وسطوح انفصام تامة تتراوح أبعادها بين 0.5 -2 مم وهي غالباً من نوع الديوبسيد ، تتراوح نسبة تواجده في الحشوات الليرزوليتية بين 5 -25٪ ويشكل وسطياً 14٪ ، في حين أن نسبتها تتزايد في الحشوات البيروكسينيتية حيث تتراوح هنا في مجال كبير 4 -69٪ وتشكل وسطياً 55٪ . يتواجد فلز الأورثوبيروكسين عل شكل بلورات وجهية إلى تحت وجهية تتراوح أبعادها بين 0.5 - 3مم غير فاسدة غالبا و تتميز بسطوح انفصام مكتملة تتراوح نسبة تواجده في الحشوات الليرزوليتية بين 13 –37٪ و تبلغ وسطيا 23٪ ، يتناقص في الحشوات البيروكسينيتية حيث تتراوح نسبته 2 -10٪ وتبلغ وسطياً 5.٪.

عند إسقاط التركيب الفلزي الحقيقي لحشوات المعطف العلوي على المخطط التصنيفي OPx-Ol-CPx (Streckeisen,1976) نجد أنها تنتشر في القطاعات المخصصة للصخور الليرزوليتية والصخور البيروكسينيتيه (شكل - 6).

يشاهد فلز السبينيل في جميع الحشوات المدروسة كفلز ثانوي يتوضع بين المكونات الفلزية الرئيسة الأخرى، تبدي حبيباته الناعمة شكلاً كسينومورفياً تأخذ في الحشوات الليرزوليتية ألواناً بنية (بيكوتيت) بينما تأخذ عند تواجدها في الحشوات

البيروكسينيتية ألواناً خضراء زيتية (هرسينيت) ، تتراوح نسبة تواجده بين < 0.3 – 10 ٪ ويشكل وسطياً حوالي 3٪.

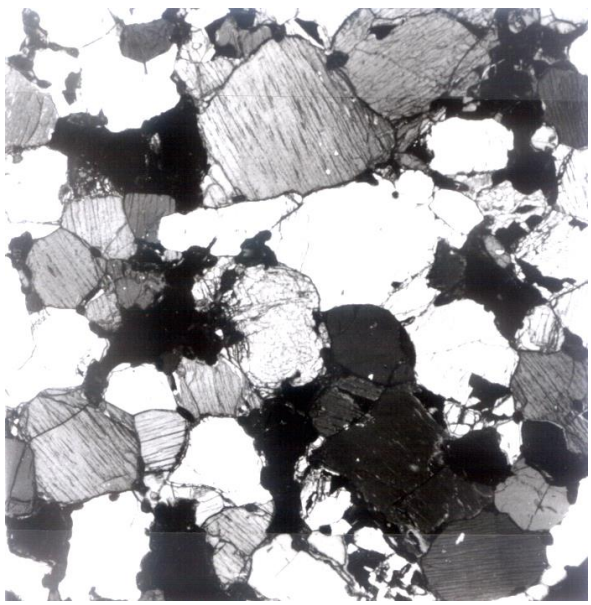
شوهد فلز الهورنبلند البني - البرتقالي المصفر في بعض الحشوات، يظهر تعدداً لونياً واضحاً يتراوح بين البني القاتم و البرتقالي المصفر و تتروح نسبته بين < 0.3 – 6٪ و يشكل وسطياً 1.2٪ من الحجم الكلي.

بتروغرافيا حشوات أسفل القشرة الأرضية:

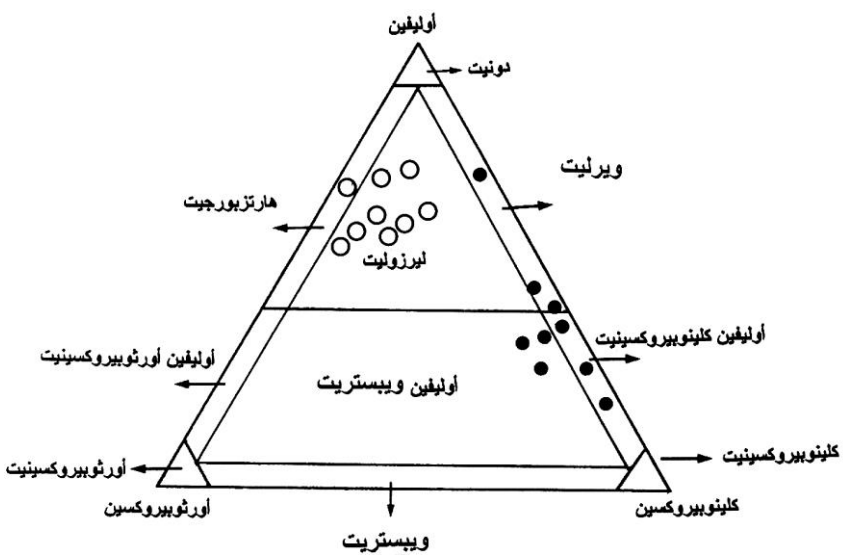
تساهم حشوات أسفل القشرة الأرضية بتقديم معلومات هامة تعكس طبيعة تركيب وبنية القشرة الأرضية: (Griffin and O'Reilly, 1987) ; (Dostal et al.1980) ; (Selverston and Stern, 1983) ; (Rudnick et al.,1986) ; (Griffin et al., 1987a;b) ; (Kay and Kay, 1981) ;(Okrusch, et al.,1979) ; (Dodge et al., 1986) ; (Loock et al., 1990) (Downes et al., 1990) (Rudnick,1992) ; (Stosch et al., 1986)

تبدو جميع الحشوات المدروسة مسطحة الحواف مستديرة إلى تحت زاوية ومتآكلة الجوانب ، تتروح أبعاد أقطارها بين 2 - 8 سم ، وتبدي تضداً غنايساً بمقاييس ميلي مترية مع بنية غرانوبلاستية واضحة (شكل -7) ، تظهر معظم الحشوات تقريباً نسيجاً غرانوليتياً متساوي الحبيبية وأحياناً نسيجاً تراكمياً ينتج من تجمع بقايا بلورات زاوية من الأورثوبيروكسين تحيط ببلورات نامية موزائيكية البنية من البلاجيوكلاز.

تتألف حشوات أسفل القشرة الأرضية من الفلزات الرئيسة التالي : كلينوبيروكسين، أورثوبيروكسين و بلاجيوكلاز إضافة إلى فلزات : الماغنيتيت، الإيلمنيت وأحياناً الكروميت، الروتيل، الأباتيت و السبينيل الأخضر (هرسينيت) كفلزات ثانوية، بعض الحشوات تحتوي على كميات ضئيلة ومحددة من الزجاج



شكل 5 : حشوة بيروكسينيت، بنية حبيبية ، عينة D-2، تكبيرX16 ، مع محلل(+).



شكل6 : المخطط التصنيفي OPx-Ol-CPx لتصنيف حشوات المعطف العلوي

(البيروكسينيت و الليرزوليت) (Streckeisen,1976).

البركاني الأصفر يتمركز غالباً على طول حدود الحبات الفلزية ويحيط غالباً بفلز البيروكسين كما يبدي هالات تفاعل قاتمة سوداء، تتميز حشوات أسفل القشرة عادة عن حشوات المعطف العلوي باختفاء فلز الأوليفين و الغارنت وإن تواجدا فعلى شكل فلزات ثانوية وبنسبة محدودة.

تتراوح نسبة فلز الكلينوبيروكسين بين 40 - 15٪ ويشكل وسطياً 32٪ بينما تتراوح نسبة فلز الأورثوبيروكسين بين 20 - 12٪ ويشكل وسطياً 16٪ من الحجم الكلي للحشوة ، في حين تتراوح نسبة البلاجيوكلاز بين 60 - 40٪ ويشكل وسطياً حوالي 50٪ من تركيب الحشوة الفلزي ، كما تتفاوت نسبة الأنورتيت في البلاجيوكلاز بين 75 - 55٪ ، و تتراوح نسبة تواجد الفلزات المعدنية بين 2 - 5 ٪ وتشكل وسطياً حوالي 3٪. لوحظ في العديد من الحشوات القشرية ظاهرة تناوب في التوزع الفلزي للبيروكسين و البلاجيوكلاز يظهر على شكل أشرطة ميلي مترية 1 -2مم سوداء إلى بنية قاتمة (غنية بالبيروكسين) تتناوب مع أشرطة أخرى فاتحة اللون بيضاء إلى زهرية (غنية بالبلاجيوكلاز). نجد عند إسقاط هذه العينات على المخطط ثلاثي الرؤوس Ol -Pg - Px (Streckeisen,1976) أنها ذات تركيب قاعدي غابروئيدي (شكل – 8).

التركيب الكيميائي للفلزات المدروسة :

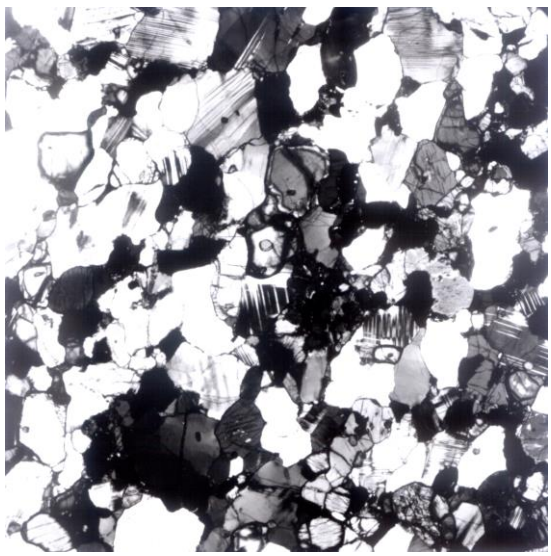
تم تحويل جميع القياسات النقطية لكل فلز من الفلزات المدروسة (الأوليفين ، الأورثوبيروكسين، الكلينوبيروكسين، الغارنت، السبينل و البلاجيوكلاز) إلى قيم أوكسيدية بالنسبة المئوية ومن ثم إلى مقادير كاتيونية موزعة طبقاً للصيغة الكيميائية للبنية البلورية لفلزي البلاجيوكلاز على أساس ثمانية ذرات من الأوكسجين و على أساس أربع ذرات أوكسجين بالنسبة للبنية البلورية لفلزي السبينل

و الأوليفين وست ذرات أوكسجين بالنسبة للبنية البلورية لفلزي الأورثوبيروكسين و الكلينوبيروكسين و ذلك باستخدام برنامج حاسوبي.

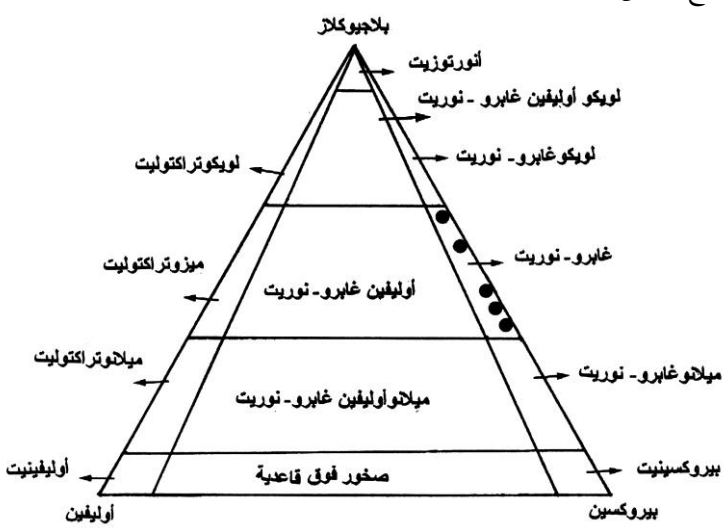
أوضحت نتائج التركيب الكيميائي لفلزات حشوات أسفل القشرة الأرضية وحشوات المعطف العلوي المدروسة تشابها كبيرا مع التراكيب الكيميائية لفلزات حشوات البراكين و الانسكابات البركانية الأخرى في سوريا (Medaris and Syada,1998;1999) وحشوات الأردن (Nasir,1992;1995) والمملكة العربية السعودية (Camp et al.,1991) ; (Camp and Roobol,1992); (McGuire, 1988 a,b) وتتميز بالخصائص التالية:

الأوليفين : يتميز فلز الأوليفين المتواجد في الحشوات الليرزوليتية (D-8,D-10,D-13,D-15,D-21) بارتفاع نسبة المغنيزيوم تتراوح بين 45.66 -49.85، كما تتراوح نسب مركباته الرئيسة في المجال ($Fo_{86.2-90.3}$-$Fa_{9.4-13.5}$) ، يبلغ متوسط محتواه من أو كسيد الكالسيوم كنسبة وزنية 0.13٪، كما يتراوح الرقم المغنيزي(X_{Mg}) بين 86.5-90.5، حيث [X_{Mg} =(100. MgO/(MgO+FeO))]. تتراوح قيم أو كسيد النيكل كنسبة وزنية بين 0.44 -0.57٪ وتشكل قيمة وسطية 0.52٪ وهي قيمة مرتفعة نسبياً عن الحشوات البيريدوتيتية المحددة من مناطق مختلفة من العالم (Franz et al.,1997);(Wedepohl,1975).

الأورثوبيروكسين (البيروكسين المستقيم): يتسم أيضا بارتفاع نسبة المغنيزيوم حيث تتراوح بين 31.95 -19.21 وهو من نوع الكلينوانستاتيت . تتراوح نسبة مركباته في حشوات الليرزوليت بين ($Ca_{2.6-3.3}$,$Mg_{84.8-86.9}$,$Fe_{9.9-12.6}$) ويبلغ متوسط محتوى أو كسيد الألمنيومAl_2O_3 = 4.37 ٪ يقابل بارتفاع واضح في محتوى أو كسيد الكروم Cr_2O_3 = 0.380٪ وينعكس هذا على الرقم الكرومي الذي يبلغ $X_{Cr\ 4.76-6.03}$.



شكل 7 : حشوة غابرو، بنية أولية متساوية الحبيبية ، عينة D-24، تكبيرX16 ، مع محلل(+)



شكل 8 : المخطط التصنيفي ثلاثي الرؤوس Ol -Pg - Px لتصنيف حشوات أسفل القشرة الأرضية (Streckeisen,1976).

حيث [X_{Cr}=(100. Cr_2O_3/(Cr_2O_3+AL_2O_3))] ، كما يتراوح الرقم المغنيزي بين X_{Mg} 85.5-90.4 (جدول -3). تزداد مركبة الانستاتيت في الحشوات البيروكسينيتية وتظهر التركيب التالي (Ca 2.4-3.2,Mg 85.7-87.1,Fe 10.4-11.7) ويزداد متوسط محتوى أوكسيد الألمنيومAl_2O_3 = 5.95٪ و الذي يقابل بانخفاض كبير في محتوى أوكسيد الكروم Cr_2O_3 = 0.105٪ ، وينعكس هذا بالتالي على الرقم الكرومي X_{Cr} 0.43-1.77، كما يتراوح الرقم المغنيزي بين X_{Mg} 87.9-90.2 . في الحشوات الغابروئيدية المتشكلة أسفل القشرة الأرضية تنخفض المركبة الانستاتية المغنيزية بشكل واضح وترتفع مقابلها المركبة الحديدية وتتميز بتركيبها التالي(Ca 1.8-3.2,Mg 57-74.6,Fe 23.3-41.2)، هذا وينخفض كل من متوسط محتوى أوكسيد الألمنيومAl_2O_3 = 2.76 ٪ والرقم المغنيزي الذي يتراوح بين X_{Mg} 57.1-74.9 .

الكلينوبيروكسين (البيروكسين المائل): يتوافق التركيب الكيميائي لفلز الكلينوبيروكسين لجميع الحشوات المقتلعة من الجزء العلوي للمعطف الأرضي مع التركيب الكيميائي للديوبسيد ، والذي ينطبق على التركيب الكيميائي لفلز الكلينوبيروكسين لحشوات الجزء السفلي للقشرة الأرضية عدا العينات D-19,D-24 حيث يكون لتركيب الكلينوبيروكسين تركيباً مماثلاً لفلز الأوجيت (جدول -4) . تتراوح نسبة مركباته في حشوات الليرزوليت في المجال بين (Ca 45.9-46.5,Mg 48.2-49.3,Fe 4.2-5.6) ويبلغ متوسط محتوى أوكسيد الألمنيومAl_2O_3 = 6.18٪ يقابل بارتفاع واضح في محتوى أوكسيد الكروم Cr_2O_3 = 0.690 ٪وينعكس هذا على الرقم الكرومي X_{Cr} 5.43-7.55، كما يتراوح الرقم المغنيزي بين X_{Mg} 86.2-90.4. في الحشوات البيروكسينيتية.

يظهر فلز الكلينوبيروكسين التركيب التالي (Ca 44.6-46.3,Mg 48.3-49.7,Fe 4.6-6.1) ويزداد متوسط محتوى أوكسيد الألمنيومAl_2O_3 = 6.30 ٪ مقابل انخفاض واضح في محتوى أوكسيد الكروم Cr_2O_3 = 0.215 ٪ ، وينعكس هذا على الرقم الكرومي

X_{Cr} 1.80-2.75 ، كما يتراوح الرقم المغنيزي بين X_{Mg} 88.6-90.2 . يتميز فلز الكلينوبيروكسين المتواجد في الحشوات الغابروئيدية المتشكلة أسفل القشرة الأرضية بتركيبه التالي(Ca 42.9-47.2,Mg 36.9-46.1,Fe 9.1-18.8) وينخفض كل من متوسط محتوى أوكسيد الألمنيوم Al_2O_3 = 3.38 ٪ و الرقم المغنيزي الذي يتراوح بين X_{Mg} 67-79.1 ويشكل وسطيا X_{Mg}75.78 .

الغارنت: يتسم التركيب الكيميائي لفلز الغارنت بتجانسه والمدى المحدود في تنوعه(جدول -2) و يتصف فلز الغارنت المرافق للحشوات البيروكسينيتية أنه من نوع الغارنت الألومينية المغنيزية ويكون أقرب ما يمكن بتركيبه الغارنت من نوع البيروب ويتراوح محتوى مركباته في المجال (Pyp. 68-74,Alm.14-18,Grs.14) . كما يتميز برقم مغنيزي عالي نسبياً يتراوح بين X_{Mg} 79.8-85.9. ورقم كرومي منخفض قيمته X_{Cr} 0.05.

السبينل: يتباين التركيب الكيميائي لفلز السبينل (جدول -2) المرافق للحشوات الليرزوليتية عن السبينل المرافق للحشوات البيروكسينيتية، يتصف الأول بتركيب (Spl.76-82,Hc.15-20,Mcr.3-4) مع نسب وزنية منخفضة من متوسط أوكسيد الألمنيومAl_2O_3 = 58.40 ٪ ونسب منخفضة من أوكسيد المغنيزيوم تقدر وسطياً بـ MgO = 21.22 % يقابلها رقم مغنيزي يتراوح بين X_{Mg} 77.4-83.2 مع رقم كرومي مرتفع يتراوح بين X_{Cr} 9.26-10.22 ، و يتصف الثاني بتركيب (Spl.76-95,Hc.3-21,Mcr.2-3) مع نسب وزنية مرتفعة من متوسط أوكسيد الألمنيومAl_2O_3 = 63.90 ٪ ونسب مرتفعة أيضاً من أوكسيد المغنيزيوم تقدر وسطياً بـ MgO =22.33 % يقابلها رقم مغنيزي يتراوح بين X_{Mg} 76.1-84.2 مع رقم كرومي منخفض يتراوح بين X_{Cr} 0.10-4.01.

البلاجيوكلاز: يتراوح تركيب فلز البلاجيوكلاز المتواجد في حشوات أسفل القشرة الأرضية ذات الطبيعة والتركيب الغابروئيدي في المجال (Ab.24-42,An.57-76,Or.0-1) أي أنه من نوع أنديزين -لابرادوريت (جدول -2).

جدول (٢)

نتائج تحليل فلز الغارنت،السبينل،الأوليفين والبلاجيوكلاز للحشوات الصخرية الليرزوليتية ،البيروكسينيتية و الغابروئيدية

Min. Xeno.Typ Samp.No.	Gar. Pyx. D-1	Gar. Pyx. D-2	Gar. Pyx. D-5	Min. Xeno.Typ Samp.No.	Spl. Lhz. D-8	Spl. Lhz. D-9	Spl. Pyx. D-6	Spl. Pyx. D-7	Spl. Pyx. D11	Min. Xeno.Typ Samp.No.	Oli. Lhz. D-8	Oli. Lhz. D-10	Oli. Lhz. D-13	Oli. Lhz. D-15	Oli. Lhz. D21	Min. Xeno.Typ Samp.No.	Plag. Gab. D-19	Plag. Gab. D-20	Plag. Gab. D-24	Plag. Gab. D-26	Plag. Gab. D-33
wt.%				wt.%						wt.%						wt.%					
SiO_2	42.15	42.44	42.94	SiO_2	0.00	0.00	0.00	0.00	0.00	SiO_2	40.38	41.28	41.33	41.66	41.35	SiO_2	54.5	53.2	48.9	51.4	49.8
TiO_2	0.01	0.01	0.01	TiO_2	0.02	0.1	0.1	0.1	0.02	TiO_2	0.00	0.00	0.00	0.00	0.00	TiO_2	0.00	0.00	0.00	0.00	0.00
Al_2O_3	23.82	23.79	24.7	Al_2O_3	58.43	58.36	62.68	65.8	63.2	Al_2O_3	0.00	0.00	0.00	0.00	0.00	Al_2O_3	29.35	30.04	33.55	31.1	31.87
Cr_2O_3	0.18	0.13	0.2	Cr_2O_3	9.92	8.88	3.9	0.1	2.98	Cr_2O_3	0.00	0.00	0.00	0.00	0.00	Cr_2O_3	0.00	0.00	0.00	0.00	0.00
FeO	7.9	8.71	5.98	FeO	7.98	10.78	11.6	8.4	9.68	FeO	12.88	10.77	9.18	9.42	9.22	FeO	0.00	0.00	0.00	0.00	0.00
Fe_2O_3	0.00	0.00	0.00	Fe_2O_3	0.00	0.00	0.00	0.00	0.00	Fe_2O_3	0.00	0.00	0.00	0.00	0.00	Fe_2O_3	0.20	0.3	0.27	0.18	0.25
MnO	0.31	0.33	0.2	MnO	0.06	0.2	0.1	0.22	0.2	MnO	0.31	0.28	0.21	0.25	0.31	MnO	0.00	0.00	0.00	0.00	0.00
NiO	0.00	0.00	0.00	NiO	0.00	0.00	0.00	0.00	0.00	NiO	0.55	0.56	0.57	0.44	0.48	NiO	0.00	0.00	0.00	0.00	0.00
MgO	19.22	19.2	20.18	MgO	21.88	20.55	20.56	24.88	21.54	MgO	45.66	48.1	48.78	49.85	48.79	MgO	0.00	0.00	0.00	0.00	0.00
CaO	5.48	5.66	5.47	CaO	0.00	0.00	0.00	0.00	0.00	CaO	0.14	0.13	0.14	0.12	0.12	CaO	11.65	12.64	15.15	14.05	14.9
Na_2O	0.00	0.00	0.00	Na_2O	0.00	0.00	0.00	0.00	0.00	Na_2O	0.00	0.00	0.00	0.00	0.00	Na_2O	4.75	4.15	2.6	3.45	2.97
K_2O	0.00	0.00	0.00	K_2O	0.00	0.00	0.00	0.00	0.00	K_2O	0.00	0.00	0.00	0.00	0.00	K_2O	0.09	0.06	0.05	0.07	0.09
Tot.	99.1	100.2	99.7	Tot.	98.3	98.9	98.9	99.5	97.6	Tot.	99.9	101.1	100.2	101.7	100.3	Tot.	100.5	100.4	100.5	100.3	99.9
Cations(O=8)				Cations(O=4)						Cations(O=4)						Cations(O=8)					
Si	3.01	3.008	3.003	Si	0.00	0.00	0.00	0.00	0.00	Si	1.005	1.003	1.007	١.00	1.008	Si	2.446	2.398	2.22	2.331	2.275
Ti	0.001	0.001	0.001	Ti	0.002	0.002	0.00	0.002	0.00	Ti	0.00	0.00	0.00	0.00	0.00	Ti	0.00	0.00	0.00	0.00	0.00
AL	2.005	1.988	2.036	AL	1.782	1.79	1.895	1.928	1.914	AL	0.00	0.00	0.00	0.00	0.00	AL	1.552	1.596	1.795	1.662	1.716
Cr	0.01	0.007	0.011	Cr	0.203	0.183	0.079	0.002	0.061	Cr	0.00	0.00	0.00	0.00	0.00	Cr	0.00	0.00	0.00	0.00	0.00
Fe^{+2}	0.473	0.516	0.35	Fe^{+2}	0.173	0.183	0.249	0.175	208	Fe^{+2}	0.268	0.222	0.187	0.191	0.188	Fe^{+2}	0.007	0.01	0.009	0.006	0.009
Fe^{+3}	0.00	0.00	0.00	Fe^{+3}	0.00	0.00	0.00	0.00	0.00	Fe^{+3}	0.00	0.00	0.00	0.00	0.00	Fe^{+3}	0.00	0.00	0.00	0.00	0.00
Mn	0.019	0.02	0.021	Mn	1E-04	0.004	0.002	0.005	0.004	Mn	0.007	0.006	0.004	0.005	0.006	Mn	0.00	0.00	0.00	0.00	0.00
Mg	2.046	2.024	2.105	Mg	0.844	0.797	0.786	0.922	0.825	Mg	1.694	1.745	1.773	1.786	1.722	Mg	0.00	0.00	0.00	0.00	0.00
Ca	0.419	0.43	0.447	Ca	0.00	0.00	0.00	0.00	0.00	Ca	0.004	0.003	0.004	0.003	0.003	Ca	0.56	0.611	0.737	0.683	0.729
Na	0.00	0.00	0.00	Na	0.00	0.00	0.00	0.00	0.00	Na	0.00	0.00	0.00	0.00	0.00	Na	0.413	0.363	0.229	0.303	0.263
K	0.00	0.00	0.00	K	0.00	0.00	0.00	0.00	0.00	K	0.00	0.00	0.00	0.00	0.00	K	0.005	0.003	0.003	0.004	0.005
Ni	0.00	0.00	0.00	Ni	0.00	0.00	0.00	0.00	0.00	Ni	0.017	0.017	0.018	0.013	0.015	Ni	0.00	0.00	0.00	0.00	0.00
X_{Mg}	81.4	79.8	85.9	X_{Mg}	83.2	77.4	76.1	84.2	80.0	X_{Mg}	86.5	88.9	90.5	90.5	90.5	X_{Mg}	0.00	0.00	0.00	0.00	0.00
X_{Cr}	0.50	0.37	0.54	X_{Cr}	10.22	9.26	4.01	0.10	3.07	X_{Cr}	0.00	0.00	0.00	0.00	0.00	X_{Cr}	0.00	0.00	0.00	0.00	0.00
Endmembers				Endmembers						Endmembers						Endmembers					
Pyp.	70	68	74	Spl.	82	76	76	89	95	Fo.	86.2	88.7	90.3	90.3	90.2	Ab	42	37	24	31	26
Alm.	16	18	14	Hc.	15	20	21	8	3	Fa.	13.5	11	9.4	9.5	9.5	An	57	63	76	69	73
Grs.	14	14	14	Mcr.	3	4	3	3	2	Mtc	0.3	0.3	0.3	0.2	0.3	Or	1	0	0	0	1

حيث: $[X_{Mg}=(100.\ MgO/(MgO+FeO))]$ و $[X_{Cr}=(100.\ Cr_2O_3/(Cr_2O_3+AL_2O_3))]$.

جدول (3)

نتائج تحليل فلز الأورثوبيروكسين (البيروكسين المستقيم) للحشوات الصخرية الليرزوليتية البيروكسينيتية و الغابروئيدية

Min. Xeno.Typ Samp.No.	Opx. Pyx. D-1	Opx. Pyx. D-2	Opx. Pyx. D-5	Opx. Pyx. D-6	Opx. Lhz. D-8	Opx. Lhz. D-10	Opx. Lhz. D-13	Opx. Lhz. D-15	Opx. Gabbro D-19	Opx. Gabbro D-20	Opx. Gabbro D-24	Opx. Gabbro D-26	Opx. Gabbro D-33
wt.%													
SiO_2	54.25	54.11	53.7	53.88	56.2	53.51	53.67	54.88	52.1	53.11	52.25	51.76	51.18
TiO_2	0.03	0.11	0.08	0.09	0.05	0.11	0.18	0.19	0.04	0.04	0.23	0.18	0.11
Al_2O_3	5.96	5.53	6.11	6.18	3.76	4.43	4.11	5.18	3.9	2.62	2.74	3.27	1.25
Cr_2O_3	0.16	0.13	0.09	0.04	0.36	0.33	0.39	0.44	0.00	0.00	0.00	0.00	0.00
FeO	6.94	6.26	7.75	7.88	6.54	8.16	9.35	6.08	19.58	16.14	16.63	17.67	25.97
Fe_2O_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MnO	0.12	0.15	0.03	0.12	0.18	0.25	0.33	0.15	0.34	0.39	0.43	0.44	0.43
NiO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO	31.69	31.95	31.56	31.85	31.59	31.3	30.56	31.65	23.37	26.78	25.45	24.44	19.21
CaO	0.76	0.7	0.88	0.67	0.78	0.76	0.81	0.97	0.81	0.56	0.78	0.93	0.73
Na_2O	0.08	0.09	0.12	0.08	0.07	0.11	0.12	0.07	0.06	0.00	0.04	0.07	0.03
K_2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot.	100.0	99.0	100.3	100.8	99.5	99.0	99.5	99.6	100.2	99.6	98.6	98.8	98.9
Cations(O=8)													
Si	1.878	1.886	1.862	1.86	1.947	1.894	1.894	1.901	1.911	1.928	1.939	1.915	1.948
Ti	0.001	0.003	0.002	0.002	0.001	0.003	0.005	0.005	0.001	0.001	0.006	0.003	0.005
AL	0.243	0.227	0.25	0.251	0.154	0.183	0.171	0.211	0.169	0.112	0.118	0.058	0.017
Cr	0.004	0.004	0.002	0.001	0.01	0.009	0.011	0.012	0.00	0.00	0.00	0.00	0.00
Fe^{+2}	0.201	0.182	0.225	0.227	0.19	0.24	0.276	0.176	0.601	0.49	0.506	0.551	0.831
Fe^{+3}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mn	0.004	0.004	0.001	0.004	0.005	0.007	0.01	0.004	0.011	0.012	0.013	0.014	0.014
Mg	1.636	1.66	1.631	1.639	1.632	1.639	1.608	1.634	1.278	1.449	1.382	1.343	1.096
Ca	0.028	0.026	0.033	0.025	0.029	0.029	0.031	0.036	0.032	0.022	0.03	0.037	0.03
Na	0.005	0.006	0.008	0.005	0.005	0.007	0.008	0.005	0.003	0.001	0.004	0.005	0.002
K	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ni	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
X_{Mg}	89.2	90.2	88.0	87.9	89.7	87.3	85.5	90.4	68.2	74.9	73.4	71.3	57.1
X_{Cr}	1.77	1.55	0.98	0.43	6.03	4.76	5.98	5.39	0.00	0.00	0.00	0.00	0.00
Endmembers													
%Ca	2.6	2.5	3.2	2.4	2.9	2.6	2.6	3.3	3.2	2.1	2.4	3.2	1.8
%Mg	85.7	87.1	86.4	87	86.6	86.9	84.8	86.8	65.2	74.6	72.4	70	57
%Fe	11.7	10.4	10.4	10.6	10.5	10.5	12.6	9.9	31.6	23.3	25.2	26.8	41.2

حيث: $[X_{Mg} = (100.\ MgO/(MgO+FeO))]$ و $[X_{Cr} = (100.\ Cr_2O_3/(Cr_2O_3+AL_2O_3))]$.

جدول (4)

نتائج تحليل فلز الكلينوبيروكسين (البيروكسين المائل) للحشوات الصخرية الليرزوليتية ، البيروكسينيتية و الغابروئيدية

Min. Xeno.Typ Samp.No.	CPx. Pyx. D-1	CPx. Pyx. D-2	CPx. Pyx. D-5	CPx. Pyx. D-6	CPx. Lhz. D-8	CPx. Lhz. D-10	CPx. Lhz. D-13	CPx. Lhz. D-15	CPx. Gab. D-19	CPx. Gab. D-20	CPx. Gab. D-24	CPx. Gab. D-26	CPx. Gab. D-33
wt.%													
SiO_2	51.85	52.15	51.62	51.82	53.85	51.15	50.42	51.32	51.70	51.55	50.80	50.85	50.36
TiO_2	0.12	0.16	0.17	0.19	0.22	0.46	0.67	0.49	0.22	0.31	0.12	0.46	0.35
Al_2O_3	6.34	5.93	6.71	6.22	5.34	6.43	5.71	7.22	3.13	2.86	2.82	3.97	4.10
Cr_2O_3	0.25	0.25	0.19	0.17	0.65	0.55	0.69	0.87	0.00	0.00	0.00	0.00	0.00
FeO	3.11	3.59	3.14	3.28	2.91	3.71	4.54	2.98	7.20	6.88	11.12	8.12	7.50
Fe_2O_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MnO	0.08	0.09	0.05	0.06	0.08	0.19	0.25	0.16	0.16	0.20	0.21	0.15	0.26
NiO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO	15.41	15.53	16.13	15.87	15.21	14.53	15.73	14.87	15.06	14.48	12.55	13.96	14.96
CaO	21.55	21.35	21.14	22.37	20.55	20.35	21.14	19.87	21.17	21.53	21.18	21.67	21.17
Na_2O	0.78	0.67	0.85	0.66	1.18	1.67	1.10	1.33	0.65	0.48	0.52	0.70	0.51
K_2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot.	99.5	99.7	100.0	100.6	100.0	99.0	100.3	99.1	99.3	98.3	99.3	99.9	99.2
Cations(O=8)													
Si	1.877	1.895	1.868	1.871	1.94	1.879	1.845	1.871	1.925	1.934	1.926	1.895	1.914
Ti	0.003	0.004	0.005	0.005	0.006	0.013	0.018	0.013	0.006	0.009	0.005	0.013	0.081
AL	0.272	0.254	0.286	0.265	0.227	0.278	0.246	0.31	0.137	0.125	0.126	0.174	0.01
Cr	0.007	0.007	0.005	0.005	0.019	0.016	0.02	0.025	0.00	0.00	0.00	0.00	0.00
Fe^{+2}	0.095	0.109	0.095	0.099	0.088	0.114	0.139	0.091	0.224	0.214	0.353	0.253	0.234
Fe^{+3}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mn	0.002	0.003	0.002	0.002	0.002	0.006	0.008	0.005	0.005	0.006	0.007	0.005	0.008
Mg	0.836	0.841	0.87	0.854	0.817	0.796	0.858	0.808	0.836	0.926	0.709	0.775	0.776
Ca	0.84	0.831	0.82	0.865	0.793	0.801	0.829	0.776	0.844	0.863	0.86	0.865	0.845
Na	0.055	0.047	0.06	0.046	0.082	0.119	0.078	0.094	0.047	0.035	0.038	0.051	0.037
K	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ni	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
X_{Mg}	89.9	88.6	90.2	89.7	90.4	87.6	86.2	90.0	79.0	79.1	67.0	75.6	78.2
X_{Cr}	2.58	2.75	1.86	1.80	7.55	5.43	7.50	7.48	0.00	0.00	0.00	0.00	0.00
Endmembers													
%Ca	45.6	46.3	46.2	44.6	46.1	45.9	46.5	46.3	47.2	45.6	44.7	42.9	44.1
%Mg	48.3	49.1	48.4	49.7	48.7	48.5	49.3	48.2	42.5	45.3	36.9	44.8	46.1
%Fe	6.1	4.6	5.4	5.7	5.2	5.6	4.2	5.5	10.30	9.10	18.40	12.30	9.80

حيث: $[X_{Mg} = (100.\ MgO/(MgO+FeO))]$ و $[X_{Cr}=(100.\ Cr_2O_3/(Cr_2O_3+AL_2O_3))]$.

الدراسة الجيوكيميائية للحشوات :

تم صياغة محتوى التركيب الكيميائي لحشوات الجزء العلوي من المعطف الأرضي الليرزوليتية و البيروكسينيتية كذا حشوات أسفل القشرة الأرضية الغابروئيدية من العناصر الكيميائية الرئيسة (أكاسيد عنصرية مقدرة بالنسبة المئوية٪) والعناصر الكيميائية الشحيحة والنادرة (مقدرة كجزء من المليون ppm) في الجدول (5).

جيوكيميائية حشوات المعطف العلوي (حشوات البيريدوتيت السبينيلي و حشوات البيروكسينيت):

على الرغم من أن الحشوات الصخرية البيريدوتيتية الليرزوليتية و البيروكسينيتية تتألف من ثلاثة فلزات رئيسة فقط هي الأوليفين، الأورثوبيروكسين و الكلينوبيروكسين والتي تمثل بتجمعها معاً نتاجاً مباشراً للانصهار الجزئي لمواد الجزء العلوي من المعطف الأرضي إلا أنها تبدي تباينات كبيرة في محتواها من العناصر الكيميائية الرئيسة و الشحيحة .

يتراوح محتوى أوكسيد المغنيزيوم في عينات الليرزولية المدروسة MgO = 36.4-47.66 ٪ ويشكل وسطياً MgO = 40.8٪ كنسبة وزنية ، تنخفض هذه القيم في الحشوات الصخرية البيروكسينيتية لتتراوح في المجال بين MgO = 15.8-26.31 ٪ ويشكل وسطياً MgO = 20.8٪.كما يتراوح الرقم المغنيزي للحشوات الليرزوليتية في المجال بين $X_{Mg\ 84.2\text{-}90.9}$ ويبلغ وسطياً $X_{Mg\ 89.3}$ ينخفض في الحشوات البيروكسينيتية حيث يتراوح بين $X_{Mg\ 79.4\text{-}89.9}$ ويبلغ وسطياً $X_{Mg\ 84.5}$. و عليه فإن التشكل و الانفصال المبكر للفلزات القاتمة الغنية بعنصر المغنيزيوم من الصهارة المهلية سيؤدي إلى تشكل صخور فوق قاعدية ذات طبيعة ليرزوليتية - هارتزبورجيتية و دونيتية قد يتم اقتلاعها ونقلها من الأعماق للسطح مع المصهور البازلتي البركاني (Nixon,1987).

تتراوح نسبة أوكسيد عنصر السيليكون في الحشوات الليرزوليتية بين SiO_2 =40.2-44.47 % وتشكل قيمة وسطية تقدر بـ41.9 % . ترتفع قيم أوكسيد عنصر السيليكون في الحشوات البيروكسينيتية لتتراوح في المجال بين 43.45-51.73 % SiO_2 كما تشكل قيمة وسطية تساوي 46.7 % .

تتراوح العلاقة بين Al/Si للحشوات الصخرية الليرزوليتية في المجال بين 0.03-0.13 لترتفع بشكل ملحوظ وواضح في الحشوات البيروكسينيتية لتتراوح في المجال بين 0.17-0.38 وهذه العلاقة تكون مرتبطة بشكل وثيق عكسياً مع العلاقة بين Mg/Si والتي تتراوح في الحشوات الليرزولية في المجال بين 1.06-1.50 لتنخفض بشكل واضح في الحشوات البيروكسينيتية و تتراوح بين 0.42-0.75 .

إن ارتفاع نسبة أوكسيد عنصر الكالسيوم الوزنية قي الحشوات البيروكسينيتية والذي يتراوح في المجال بينCaO = 7.85-16.83 % مقارنة مع محتواه المنخفض نسبياً في الحشوات الصخرية الليرزوليتية والذي يتراوح في المجال بين CaO= 0.46-3.65 % ، ينعكس بشكل مباشر على العلاقات العنصرية التالية: تكون قيم العلاقة CaO/MgO منخفضة في الحشوات الليرزولية و تتراوح بين 0.01-0.109، لترتفع قي الحشوات البيروكسينيتية و تتراوح بين 0.288-1.008، أيضاً العلاقة CaO/Al_2O_3 تكون منخفضة نسبياً في الحشوات الصخرية الليرزوليتية و تتراوح بين 0.42-0.96، ترتفع في الحشوات البيروكسينيتية لتتراوح في المجال بين 0.81-1.95 .

يتضح من (الشكل : 9أ و 9ب) مخطط العلاقة بين أوكسيد عنصر المغنيزيوم MgO والعناصر الكيميائية الرئيسة والشحيحة والنادرة وجود علاقة ارتباط خطية سلبية بين أوكسيد المغنيزيوم وجميع العناصر الكيميائية النادرة مثل: (Yb,La,Sm,Y,Nd,Ce,Nb) .وأيضاً مع أكاسيد العناصر الكيميائية الرئيسة التالية: $CaO, Al_2O_3, K_2O, Na_2O$ بينما لا يظهر أوكسيد عنصر الكروم Cr_2O_3 علاقة واضحة

جدول (٥)

نتائج تحليل العناصر الكيميائية الرئيسة بـــ % والشحيحة بـــ ppm للحشوات الصخرية الليرزوليتية ،البيروكسينيتية و الغابروئيدية

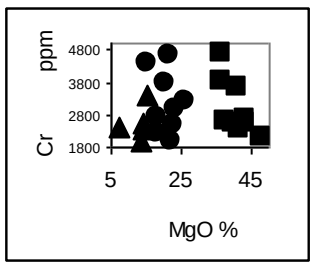
Samp.No.	D-1	D-2	D-3	D-4	D-5	D-6	D-7	D-11	D-12	D-8	D-9	D-10	D-13	D-14	D-15	D-16	D-17	D-21	D-19	D-20	D-24	D-26	D-33
Xeno.Typ	Pyx.	Pyx.	Pyx.	Pyx.	Pyx.	Pyx.	Pyx.	Pyx.	Pyx.	Lhz.	Lhz.	Lhz.	Lhz.	Lhz.	Lhz.	Lhz.	Lhz.	Lhz.	Gab.	Gab.	Gab.	Gab.	Gab.
wt.%																							
SiO_2	45	43.45	47.12	51.61	44.2	51.73	45.16	46.8	45.35	42.67	43.95	43.9	44.47	40.2	43.75	42.42	43.68	40.9	44.86	45.92	43.1	45.99	39
TiO_2	0.23	0.2	1.32	0.32	0.59	0.35	1.43	0.12	1.06	0.47	0.26	0.05	0.64	0.78	0.15	0.17	0.04	0.07	1.37	1.4	4.25	1.44	5.52
Al_2O_3	10.41	14.6	11.26	7.54	11.08	7.77	8.33	9.42	10.61	2.8	2.63	3.4	4.68	4.77	6.27	3.24	4.11	1.04	12.81	13.68	16	12	15.3
Fe_2O_3	0.52	1.25	5.3	0.86	3.17	0.75	2.79	4.27	0.83	1.85	1.34	1.39	1.79	5.16	0.8	3.42	4.1	3.98	3.32	3.25	11.18	8.23	10.64
FeO	5.45	5.14	2.32	3.41	3.85	4.71	7.64	3.7	7.28	7.18	6.5	7.38	6.46	7.7	6.0	5.17	5.55	5.16	7	5.91	2.64	6.78	0.28
MnO	0.16	0.15	0.15	0.12	0.14	0.17	0.15	0.12	0.14	0.14	0.13	0.15	0.14	0.18	0.1	0.14	0.14	0.13	0.18	0.16	0.18	0.21	0.1
MgO	21.4	22.57	15.18	20.63	17.84	22.32	26.31	17.9	23.16	43.41	43.21	39.55	36.4	36.56	37.33	41.73	41.06	47.66	14.34	14.22	7.0	15.09	13.69
CaO	15.53	11.83	15.3	14.73	16.83	11.27	7.58	15.8	10.25	1.45	1.39	2.64	3.97	3.65	2.99	3.12	1.71	0.46	13.59	13.57	10.66	8.9	10.8
Na_2O	0.83	0.37	1.66	0.75	0.75	0.73	0.63	0.66	0.23	0.23	0.13	0.19	0.47	0.49	0.13	0.2	0.05	0.04	0.73	1.33	3.28	1.24	2.3
K_2O	0.09	0.09	0.39	0.3	0.07	0.03	0.23	0.2	0.22	0.06	0.04	0.04	0.63	0.03	0.02	0.28	0.18	0.03	0.28	0.13	0.39	0.13	1.5
P2O5	0.03	0.10	0.32	0.19	0.09	0.17	0.37	0.04	0.31	0.07	0.06	0.03	0.07	0.04	0.09	0.27	0.04	0.04	0.27	0.26	0.11	0.04	0.07
H2O	0.2	0.25	0.22	0.10	0.36	0.25	0.22	0.45	0.25	0.20	0.20	0.22	0.30	0.25	0.20	0.32	0.20	0.2	0.35	0.25	0.84	0.71	0.3
Tot.	99.9	100	100.5	100.6	99	100.3	100.8	99.5	99.7	100.5	99.8	98.9	100	99.8	97.8	100.5	100.9	99.7	99.1	100.1	99.6	100.8	99.5
X_{Mg}	86.7	86.6	79.4	89.9	82.7	88.2	82.3	81.0	83.8	89.8	91.0	89.2	89.0	84.2	90.9	90.1	88.9	90.7	72.1	74.3	49.8	65.7	71.4
ppm																							
Sr	12	222	341	41	103	44	925	12	544	89	88	18	128	69	278	5	0	9	372	226	124	238	613
V	214	205	217	259	328	221	83	250	142	44	45	57	98	92	32	58	55	97	271	229	182	510	163
Zr	22	22	139	24	22	28	177	49	147	45	56	49	73	95	36	8	9	11	188	90	145	60	39
Cr	4626	2504	4400	3800	2213	1973	3206	2737	2974	2564	2636	2532	4680	3804	2575	2365	3651	2121	2508	2340	2423	3415	1980
Ni	1800	1030	2550	2600	2360	580	2124	2054	2056	2318	2083	2290	2006	1986	1412	1997	2045	1523	1356	1815	1552	2827	664
Co	56	57	70	58	59	65	117	221	76	160	161	130	146	185	124	182	229	245	103	92	74	136	114
Nb	4.5	3.6	5.2	7.2	3.8	4.2	6.2	4.3	5.4	0.87	0.98	0.83	1.05	0.94	1.23	0.96	0.86	1.32	9.0	6.0	5.0	7.0	11
Y	13	15	18	16	15	10	12	16	14	5.0	6.1	4.2	5.1	3.8	7.1	5.2	4.5	4.9	36	23	18	20	22
La	3.2	2.7	3.5	3.1	2.8	2.9	4.1	2.9	3.7	0.98	0.88	0.55	0.62	0.46	0.52	0.74	0.48	0.74	4.22	5.1	6.62	3.52	7.48
Ce	7.6	8.3	6.3	5.9	6.4	7.1	8.3	6.3	7.4	2.23	2.22	1.5	1.86	3.11	2.96	2.56	3.45	2.74	11.12	15.2	15.26	8.12	13.8
Nd	5.3	4.8	3.9	5.1	3.7	5.6	6.1	5.2	4.5	1.16	1.13	1.88	0.98	1.53	1.67	0.87	0.92	1.08	12.6	9.8	12.1	14.2	9.4
Sm	0.87	1.32	0.92	1.35	0.89	1.47	1.57	1.51	1.23	0.31	0.29	0.18	0.17	0.22	0.2	0.19	0.21	0.24	1.97	2.74	2.65	2.05	3.53
Yb	0.41	0.32	0.29	0.33	0.37	0.42	0.38	0.36	0.33	0.2	0.21	0.15	0.18	0.21	0.28	0.26	0.26	0.2	1.3	1.98	1.9	1.8	2.52
La/Yb	7.8	8.4	12.1	9.4	7.6	6.9	10.8	8.1	11.2	4.9	4.2	3.7	3.4	2.2	1.9	2.8	1.8	3.7	3.2	2.6	3.5	2.0	3.0

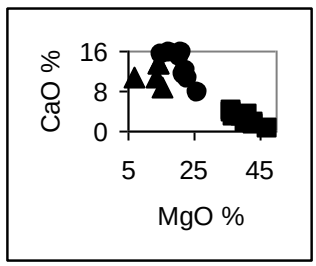
حيث: $[X_{Mg} =(100.\ MgO/(MgO+FeO))]$ و $[X_{Cr}=(100.\ Cr_2O_3/(\ Cr_2O_3+AL_2O_3))]$.

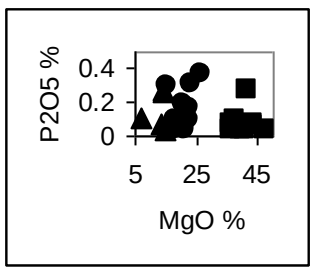
مع MgO ويمكن إعادة ذلك إما بسبب إحلال جزء من عنصر الكروم في فلز الكلينوبيروكسين "الديوبسيد الكرومي" أو في فلز السبينيل الكرومي أو بسبب الانفصال المبكر لجزء منه من الصهارة المهلية ثقالياً على شكل فلز الكروميت . يتضح أيضاً وجود علاقة ارتباط خطية إيجابية بين أوكسيد المغنيزيوم و عنصر الكوبالت. تتراوح قيمة العلاقة La/Yb في الحشوات الصخرية البيريدوتيتية الليرزوليتية بين 1.8-4.9 و التي ترتفع بشكل واضح قي الحشوات البيروكسينيتية لتتراوح في المجال بين 7.6-12.1. كما يلاحظ ارتفاع لجميع قيم العناصر الكيميائية النادرة Y,La , Ce , Nd , Sm في الحشوات البيروكسينيتية عنها في الحشوات الليرزوليتية (جدول 5).

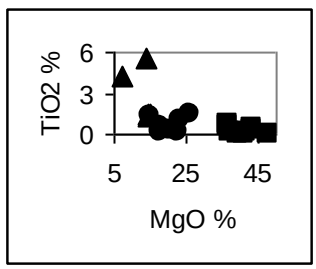
جيوكيميائية حشوات أسفل القشرة الأرضية:

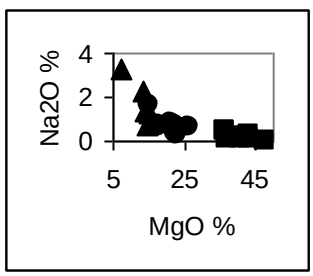
تتباين التراكيب الكيميائية لحشوات أسفل القشرة الأرضية في مجال واسع (جدول - 5) كما أنها تتباين بشكل واضح وكبير عن حشوات الجزء العلوي للمعطف الأرضي (الشكل : 9أ – 9ب) فالنسبة MgO/ SiO_2 تكون منخفضة في حشوات القشرة الأرضية وتتراوح بين 0.16-0.32 تزداد قيمتها في الحشوات البيروكسينيتية وتتراوح بين 0.40-0.56 و ترتفع في الحشوات الليرزوليتية لتتراوح في المجال 0.82-1.17. يكون الحال مشابهاً أيضاً في النسبة MgO/Al_2O_3 حيث تكون منخفضة في حشوات القشرة الأرضية وتتراوح قيمتها بين 0.44-1.26 في حين أنها تتراوح في الحشوات البيروكسينيتية بين 1.35-3.16 وفي الحشوات الليرزوليتية بين 5.95-45.83.

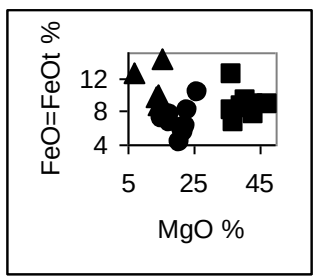


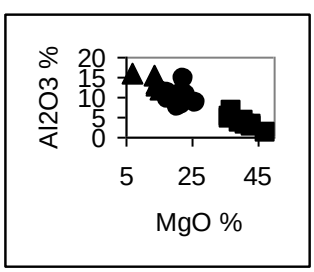


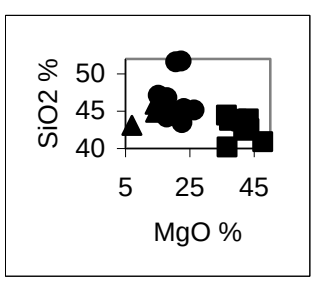




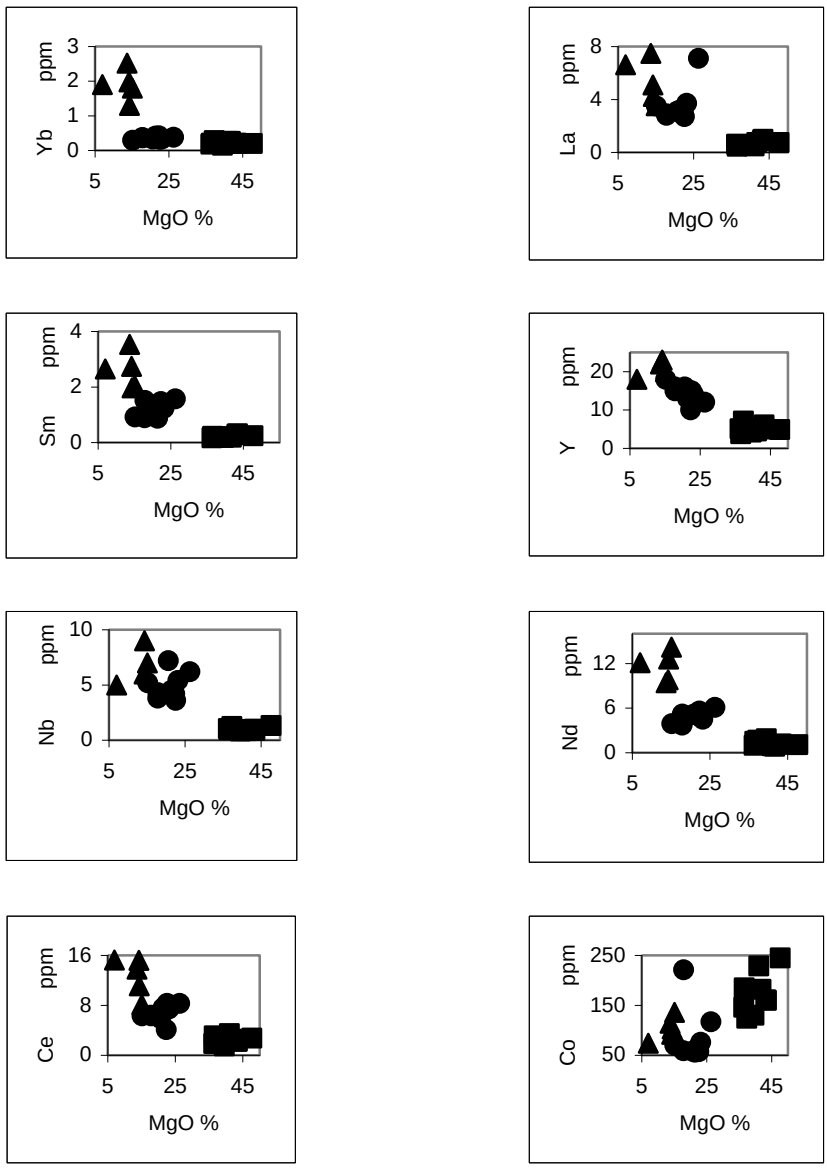






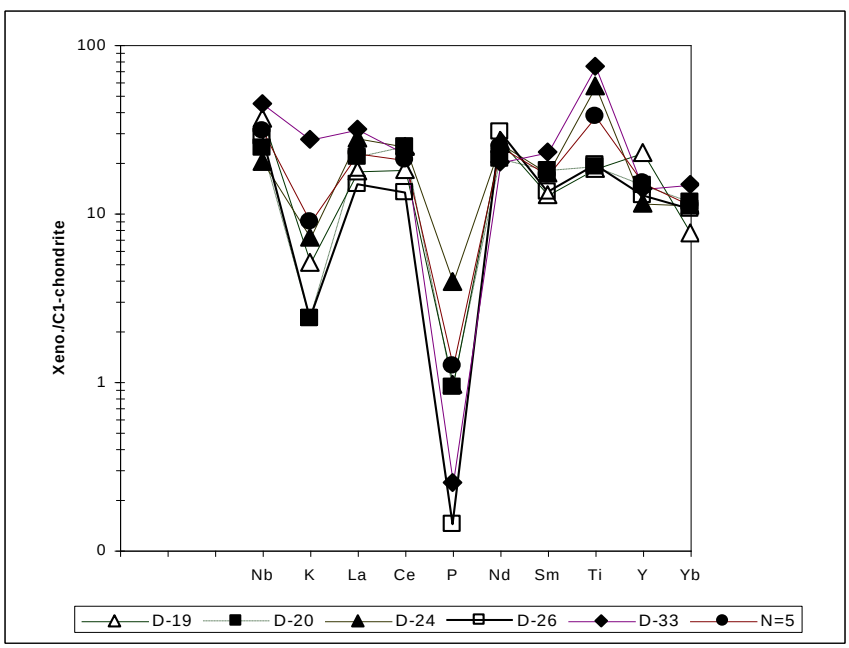


شكل 9 أ: مخططات مقارنة المتغايرات الكيميائية لبعض أكاسيد العناصر الكيميائية الرئيسة مع أوكسيد عنصر المغنيزيوم (■ : ليرزوليت، ● : بيروكسينيت، ▲ :غابرو)



شكل 9 ب: مخططات مقارنة المتغايرات الكيميائية لبعض العناصر الكيميائية الشحيحة و النادرة مع أوكسيد عنصر المغنيزيوم (■ : ليرزوليت، ● : بيروكسينيت، ▲ :غابرو).

نجد لدى مقارنة محتوى حشوات أسفل القشرة الأرضية الغابروئيدية المدروسة من العناصر الكيميائية النادرة مثل: (Nb ,La , Ce , Nd , Sm , Y , Yb) والعناصر الكيميائية الرئيسة مثل : (K , P ,Ti) مع تلك الموجودة في الكوندريت (Sun and McDonough,1989) اغتنائها بهذه العناصر عدا العينتين D 26 - و D-33 اللتين تظهران افتقاراً محسوساً في عنصر الفوسفور (شكل - 10) . أيضاً لدى إسقاط محتوى العناصر الكيميائية الرئيسة و الشحيحة و النادرة لهذه الحشوات على مخططات (Miyashiro and Shido,1975) SiO_2 مقابل FeO^H/ MgO و SiO_2 مقابل Cr و مخططات (Winchester and Floyd,1976) P_2O_5 مقابل Zr و Nb / Y مقابل Zr / P_2O_5 تتمركز في القطاعات المخصصة للصخور القاعدية المهلية ثولوئيتية الطبيعة.



شكل 10 : يبين الشكل مضاهاة بعض العناصر الكيميائية للحشوات الغابروئيدية مع محتواها في الكوندريت

تقدير حرارة وضغط التشكل للحشوات:

أ - تقدير حرارة (جيوتيرموميتر) التشكل للحشوات المدروسة:

تعتمد معظم المخططات الجيوتيرموميترية على نوعين من المعايير:

يعتمد النوع الأول على مقدار الانحلالية المتوازنة بين فلزي الكلينوبيروكسين .CPx والأورثوبيروكسين .OPx أو التبادل الأيوني المتزن للعناصر الكيميائية بينهما ، وينتمي لهذا النوع كل من معايير:

(Wells,1977) ; (Mysen,1973) ; (Hensen ,1973) ; (Boyd and Nixon,1973) ; (Bertrand and Mercier,1985); (Brey and Koehler,1990); (Berchova,1996).

يعتمد النوع الثاني على التبادل الأيوني المتوازن للعناصر الكيميائية بين فلزين أو أكثر، وينتمي لهذا النوع كل من المعايير الجيوحرارية التالية :

- مخطط (Witt-Eickschen and Seck,1991) المعتمد على تغير محتوى عنصر الألمنيوم في فلز الأورثوبيروكسين المتوازن مع فلزي الأوليفين و السبينل.
- مخطط (Ellis and Green,1979) المعتمد على تبادل عنصر الحديد مع عنصر المغنيزيوم بين فلزي الغارنت و الكلينوبيروكسين.
- مخطط (Powell,1985) المعتمد على تبادل عنصر الحديد مع عنصر المغنيزيوم بين فلزي الغارنت و الكلينوبيروكسين.
- مخطط (Krogh-Ravna,2000) المعتمد على تبادل عنصر الحديد مع عنصر المغنيزيوم بين فلزي الغارنت و الكلينوبيروكسين.
- مخطط (Harly,1984a) المعتمد على تبادل عنصر الحديد مع عنصر المغنيزيوم بين فلزي الغارنت و الأورثوبيروكسين.
- مخطط (Balhaus et.al.,1991a;b) المعتمد على تبادل عنصر الحديد مع عنصر المغنيزيوم بين فلزي الأوليفين و السبينل.

- مخطط (Sachtleben and Seck,1981) المعتمد على تغير محتوى عنصر الكالسيوم في فلز الأورثوبيروكسين.
- مخطط (Witt-Eickschen and Seck,1991) المعتمد على تبادل عنصر الكروم مع عنصر الألمنيوم بين فلزي الأورثوبيروكسين و السبينل.

تم استخدام أربعة معايير جيوحرارية في هذه الدراسة وتم صياغة قيم درجات حرارة التشكل بالدرجة المئوية م° لحشوات الجزء العلوي من المعطف الأرضي الليرزوليتية والبيروكسينيتية و كذلك حشوات الجزء السفلي للقشرة الأرضية الغابروئيدية في الجدول (6) والذي بين تطابق حقول القيم الحرارية لتشكل كل مجموعة حشوية، حيث تتشكل الحشوات الليرزوليتية في مجال حراري يتراوح بين 915 -1060 م° ، ويتراوح بالنسبة للحشوات البيروكسينيتية بين 945 – 1035 م° ، تنخفض هذه القيم بالنسبة للحشوات الغابروئيدية لتتراوح في المجال بين 820 – 950 م°.

ب - تقدير ضغط (جيوباروميتر) التشكل للحشوات المدروسة:

يعتبر تحديد ضغط التشكل للحشوات الصخرية أمراً صعباً و لا يمكن تحقيقه بشكل دقيق لهذا يعتمد كثير من الباحثين لدى تقديرهم درجات ضغط التشكل على سحنات التوازن الفلزي للمترافقات الفلزية ، حيث يعتبر تواجد فلز الغارنت في الحشوات الليرزوليتية مؤشراً هاماً لبدء القيم المرتفعة للضغط و التي تبدأ عند ضغط 19 كيلوبار عند درجة حرارة 1100 م° بينما يعتبر تشكل فلز البلاجيوكلاز مؤشراً ضرورياً للانتقال إلى سحنات توازن فلزية منخفضة تبدأ بضغط 8 كيلوبار وفي درجة حرارة 1100 م° . أعطت الحشوات البيروكسينية المدروسة على مخطط (Wood,1974) ضغط تشكل تراوح في المجال بين 13.5 – 14 كيلوبار.

كما أنه ليس من السهل تقدير ضغط تشكل حشوات الجزء السفلي للقشرة الأرضية ذات الطبيعة الغابروئيدية الخالية بشكل عام من فلز الغارنت، لذا يعتمد في تقديره على مقارنة المترافقات الفلزية و تحديد درجات ثبات الطور بالنسبة لها خاصة عند انتقالها لسحنة الصخور الايكلوجيتية ; (Green and Ringwood,1967) (Wood,1987); أوضح (Irving,1974) ; (Ito and Kennedy,1971) ; (Herzberg,1987) أنه في حال غياب فلز الأوليفين يسود ضغط تشكل 6 كيلوبار وبشروط حرارية مرافقة تصل لـ800 م° ، بينما يقتضي غياب فلز الغارنت ضغطاً يتراوح بين 9 -10 كيلوبار عند درجة حرارة 1100 م° ، لذا يمكن الافتراض أنه وضمن الشروط الحرارية المفترضة لتشكل الحشوات الغابروئيدية المدروسة ساد ضغط تراوح بين 6 – 8 كيلوبار وعمق تشكل تراوح بين 20 –27 كم .

جدول (6)

قيم حرارة و ضغط تشكل الحشوات المدروسة.

نوع المخطط	حشوات الجزء العلوي من المعطف الأرضي							حشوات الجزء السفلي من القشرة الأرضية				
	حشوات الليرزوليت				حشوات البيروكسينيت			الحشوات الغلبروئيدية				
	D8	D10	D13	D21	D1	D2	D5	D6	D19	D20	D24	D26	D33
نوعي البيروكسين Wells,1977	1015	1020	915	1015	980	1005	1010	945	940	945	855	865	950
نوعي البيروكسين Brey & Koehler,1990	1040	1050	930	1060	980	1025	1010	925	865	935	875	820	825
محتوى عنصرال Ca في OPx. Brey & Koehler,1990	1010	995	1015	1050	985	970	1025	960					

محتوى عنصرال Ca في OPx. Sachtleben & Seck,1981	1010	1015	1030	1060	1005	975	1035	985					
Wood,1974					14	14.5	13.5		6 - 8				

وبشكل عام يمكن القول أن هذه النتائج (القيم الجيوضغطية و الجيوحرارية) للحشوات المدروسة تتشابه مع القيم والمجالات الحرارية المحددة في دراسات سابقة من قبل العديد من الباحثين. فلقد حدد(Sharkov et.al.,1989) للحشوات الليرزوليتية المدروسة من تل دنون ضغط تشكل تراوح بين 10 - 20 كيلوبار عند شروط حرارة تشكل حددها (Turkmani ,1995) بالنسبة لحشوات الليرزوليت السبينيلى في المجال بين 932 -1055 م° و لحشوات الهارتزبورجيت 948 - 1115 م° و لحشوات الويبستريت 982 - 1140 م° ،أما بالنسبة للحشوات الليرزوليتية المنتشرة في تل الأشاعر فقد حدد (Medaris and Syada,1998) ضغط تشكل يصل لـ 18.8 كيلوبار مع حرارة مرافقة تتراوح بين 1000 - 1050 م° وعمق تشكل مفترض تراوح بين 40 -6 - كيلومتر، أما بالنسبة للحشوات البيروكسينيتية المنتشرة في ذات الموقع فقد حدد (Medaris and Syada, 1999) ضغط تشكل تراوح بين 11.5 - 13.8 كيلوبار وحرارة تراوحت في المجال بين 970 - 1040 م° .

كذلك تم تحديد شروط حرارة تشكل الحشوات الليرزوليتية المدروسة في تل خنفة في المجال بين 925 - 1125 م° مع ضغط تشكل تراوح بين 15 - 20 كيلوبار وعمق تشكل مفترض تراوح بين 30 - 60 كيلومتر (Syada et al.,1996).

حدد(Nasir and Al - Fugha,1988) شروط تشكل حرارية للحشوات الصخرية الليرزوليتية السبينيليتية المأخوذة من تل أرثين تتراوح بين 925 - 1025م° وعمق تشكل افتراضي يصل إلى 37 كيلومتر، وتم تحديد مجالات حرارية وضغطية

للحشوات المأخوذة من عدة مواقع من البراكين الأردنية (Nasir et al.,1992) تتراوح بالنسبة للحشوات البيروكسينيتية بين (11 - 13 كيلوبار للضغط ، 940 - 1020 م° للحرارة) وللحشوات الليرزوليتية (12 - 18 كيلوبار للضغط ، 920 - 1030 م° للحرارة) وللحشوات الغابروئيدية الطبيعة بين (5 - 11 كيلوبار للضغط ، 775 - 800 م° للحرارة عند عمق افتراضي يتراوح بين 17 - 35كيلومتر).

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Petrographical and Geochemical Study of the Basic and Ultrabasic Xenoliths Associating The Quaternary Alkali Basalts of the Shamah Volcanic Fields (Southwest - Syria)

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Abstract :

Alkali basalt spread northeast part of Shamah volcanic field (southwest of Syria) belonging to the Neogene and Quaternary ages,which are coexisted with a great quantity of mafic and ultramafic xenoliths and megacrysts.

Field observations and data of geochemical and petrographical studies results, for xenoliths coexisted with alkali basalt spread over the northwest part of the Arabian plate (Syria) indicate availolility of a proper enviroment where various kinds of xenoliths of lower crustal and upper mantle were formed,this indicate that thes xenoliths have been formed under different thermobarometric conditions.

The study of available mineral paragenesis and geothermobarometrics on coexisting minerals suggest equilibration conditions,ranging between 6 - 8 Kbar. for pressure and 850 - 920^{o}C for temperature,and that is for xenolths of gabbroic nature formed in the lower crustal between 20 - 27 Km depth.With regard to the formation conditions of the xenoliths formed in the upper mantle(Pyroxenite and Lherzolite); they range between 13.5 - 14.5 Kbar. for pressure and 950 - 1060^{o}C for temperature .

ورغم أن نموذج البريون المحور كمسبب لأمراض البريون هو الأكثر قبولا في الوقت الراهن، فإن هناك فرضيات أخرى عدة حول طبيعة العامل المسبب لهذه الأمراض ومنها فرضية الفيروس والفيرينو و"الرقيب" (Chaperone) وكذلك فرضية أنها من الأمراض التخزينيية للأجسام الحالة، ولكن لم يتم حتى الآن إثبات أي من هذه الفرضيات أو استبعادها بشكل قاطع.

هذا ويتناول الجزء الأول من هذه الاستعراض العلمي ما تمت معرفته حتى الآن عن مسببات أمراض البريون والفرضيات الأساسية حول طبيعة تلك المسببات وآليات تكاثرها.أما الجزء الثاني فيتناول السمات الإكلينيكية والباثولوجية لأمراض البريون في الإنسان والحيوان وما تمت معرفته حتى الآن عن تشخيص هذه الأمراض وإمكانية علاجها.

استعراض علمي
أمراض البريون : (1) العوامل المسببة لأمراض البريون

منصور بن فارس حسين و سعود بن إبراهيم المفرج
قسم الإنتاج الحيواني – كلية علوم الأغذية والزراعة
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الملخص :

تشكل أمراض البريون أو الاعتلالات الدماغية الإسفنجية المعدية مجموعة فريدة من الأمراض العصبية التنكسية في الإنسان والحيوان، وتتميز هذه الأمراض إكلينيكيا بالخلل العقلي (العته) و الاضطرابات العصبية والحركية، فالموت، ومن الناحية الباثولوجية بالتنكس الفجوي للخلايا العصبية، والدباغ و ارتشاح الخلايا النجمية في نسيج المخ.

وبخلاف جميع الأمراض الأخرى فإن أمراض البريون هي الوحيدة التي تعد أمراضا معدية و وراثية في آن معا، كما أنها الوحيدة التي يسببها على ما يبدو نوع من "البروتين المعدي" يسمى بريون وهو بروتين محور يقاوم الأنزيمات الحالة للبروتينات ويمكن "التكاثر" داخل الخلايا العصبية في غياب أية حموض نووية. ويشار إلى ذلك البروتين الممرض بالبريون المقاوم للهضم (PrP^{res}) أو بريون مرض الرجفان (PrP^{SC}) ويعتقد انه يتكون نتيجة للتحور في تشكل نظير غير ممرض للبروتين نفسه، موجود بشكل طبيعي في خلايا الجسم ويشار إلية باسم البريون الخلوي (PrP^{C}).

وقد ازداد الاهتمام بدرجة كبيرة بأمراض البريون وذلك في أعقاب حدوث الوباء الهائل لجنون البقر (اعتلال الدماغ الإسفنجي البقري) في بريطانيا، وما تلاه من اكتشاف عشرات الحالات من مرض كروزفلد جاكوب المغاير الجديد في الإنسان، والذي ينجم عن اكتشاف العدوى من البقر إلى الإنسان. وقد نشر عدد كبير من البحوث حول هذه الأمراض في الآونة الأخيرة.

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Conclusion:

Although several hypotheses have been put forth to explain the propagation of the prion disease agent(s), two hypotheses, namely the "prion only" and the virino hypothesis, have been the focus of greatest attention. While neither of them has been unequivocally confirmed or ruled out experimentally, the hypothesis that PrP protein might be the sole component of the infectious prion disease agent has gained a much wider popularity because of consistent failure to identify a specific "foreign" nucleic acid in prion diseases despite extensive search.

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PrP transformation is the lysosome itself [41]. Other hypotheses have incriminated autoimmune reactions, bacterial toxicosis, chemical agents, glycosidase inhibitors and a host of other factors in the etiology of prion diseases, but none of these has in fact been adequately substantiated.

Fig 3: Species Barrier: If prions are transmitted from a mouse or hamster to another animal of the same species, the disease develops in the recipient after a comparatively shorter incubation period, but if prions are transmitted from one species to another, e.g., from mouse to hamster, the disease develops after a much longer incubation period, or not at all. However, if the "hamster" prions were passaged repeatedly in the mouse, the incubation period of the disease in the mouse decreases dramatically and stabilizes at a new value. This is called "species barrier" and was considered to be an evidence of viral infection. However, it was found that if you introduce the PrP of the donor species (the hamster) into the recipient species (mouse), the latter animal becomes as equally susceptible to the hamster prions as the hamster. From Heaphy [6].

2.3. *Chaperone Hypothesis*:

This hypothesis does not violate the dogma that replication occurs only in the presence of nucleic acid. It has been found by spectroscopic methods that conversion of PrP^{C} to PrP^{SC} involves profound conformational changes, which probably require a chaperone mediator [38- 40]. Chaperones are proteins that direct the folding and unfolding of other proteins, and the chaperone hypothesis is based on the suggestion that a certain protein factor(s), called X factor, which might be a chaperone, is involved in the formation of PrP^{SC} [15]. It has been suggested that PrP^{SC} itself could be protein X or the chaperone that produces the conformational change. However, studies on the interactions between PrP^{C} and PrP^{SC} do not support this argument [15; 23]. Some heat shock proteins are also known to act as chaperones, and it has been found that some changes do occur in the inducibility and the distribution of these proteins in scrapie-infected cells [10; 38-40].

With the identification of an increasing number of “conformational” diseases, or protein misfolding diseases, the chaperones are becoming the focus of increasing interest and considerable research is currently underway to design novel chaperone drugs to correct the structural problem.

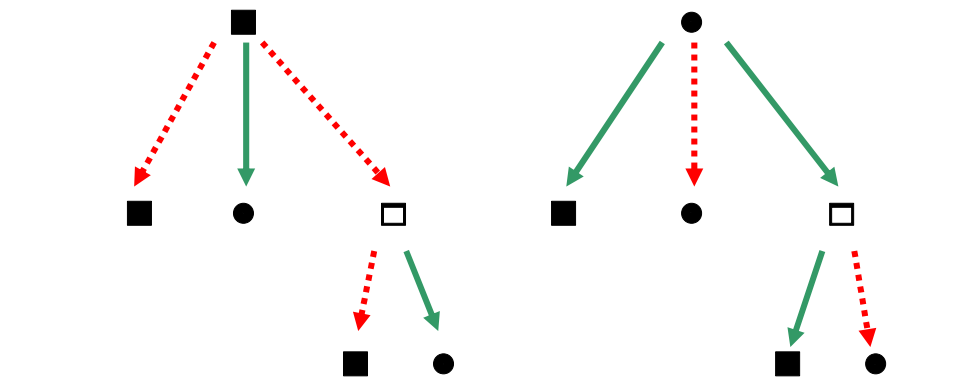
Other Hypotheses:

The massive outbreak of bovine spongiform encephalopathy (BSE) has triggered numerous other hypotheses about the possible causative agents of prion disease. One of these hypotheses suggests that prion diseases could be lysosomal storage diseases and there are studies suggesting that the site of

protein is produced from the genes of the host animal, it has a different structure in different species, and that is why the host barrier exists [15; 16].

Nevertheless, it must be emphasized that the capability of prion protein to replicate in the absence of nucleic acid could only be proven unequivocally if the misfolded prion (PrP^{SC}) is synthesized in a way that totally eliminates any possible presence of nucleic acid, then injecting this synthetic prion and observing whether it replicates or not. So far, all attempts to achieve that have been unsuccessful [20].

Finally, in an attempt to reconcile the concept of infectious protein, which explains the existence of "strains" on the basis of stable variations in the PrP^{SC} molecules, with the virino concept, which explains "strains" on the basis of nucleic-acid encoded information, Weissmann [28] introduced the so-called "unified theory," in which he suggested that PrP might be associated with a host-derived episomal nucleic acid, which encoded for strain-specificity but was not essential for infectivity.



Westaway *et al*. [19], on the other hand, argued that since PrP is encoded by the human genome, variations in the gene sequence could have a profound effect on the occurrence and course of disease, and the length of the incubation period. Prusiner et al. [25] also argued that differences between "strains" do not necessarily mean presence of genetic information specific for each strain, but rather that the prion protein adopted different conformations, with consequently different effects. Furthermore, they stated that the infectivity of a certain type of PrP^{SC} depends on how closely it resembles the host's own prion.

Hecker *et al*. [34] introduced the so-called “targeting hypothesis” in which they suggested that strain-specificity is determined by the cell subtypes in which the propagation of PrP^{SC} molecules took place. By contrast, Bessen *et al*. [35] and Kocisko et al. [36] reported that species-specific PrP conversion into protease-resistant forms could be achieved in a cell-free system, although the possibility cannot be ruled out that some cell-type specific components that conferred strain-specificity might have “contaminated” the cell-free culture via PrP preparations.

On the other hand, numerous transmission studies suggested that when infective material is transmitted from one species of animal to another, as for example when mice are inoculated with scrapie infective material from sheep, the required dose is initially extremely high, the incubation period is prolonged and the pathology of the disease is altered. However, after repeated passages of the infection in the new species, in this case the mouse, there is a dramatic reduction of the incubation period, which becomes stabilized at a new value. Besides, when a species becomes infected with a prion disease of a different species, it can transmit the infection more easily to other members of its own species, and may also infect a wider range of new species that the original host could not. All of this has to do with the existence of a *species barrier*, which offers a strong argument in support of a viral etiology. To verify that question, an important experiment was conducted by Scott *et al*. [37] in which they showed that if a hamster PrP gene was inserted into mice, this would remove the species barrier between the two species; i.e. when a mouse into which the hamster PrP gene was inserted is injected with scrapie from a hamster, the mouse would develop scrapie as if it were a hamster [Fig 3]. This was taken as evidence that the PrP protein, rather than a virus, was the “infective agent” and since this

Supporters of the viral hypothesis argue that PrP might be an important element in disease development - e.g., it could be a host-cell receptor that directs an unknown virus into the cell and thereby control susceptibility - but there must be a nucleic acid that controls its synthesis. They also argue that abnormal prion (PrP^{SC}) could be an intermediary or a product of cell destruction, rather than the cause of it [20; 32].

Some of the features of prion diseases are commensurate with viral infections. For example, although prion diseases have many features in common, there are differences between them such as differences in the length of the incubation period and host range, as well as changes in the infectivity of different organs and tissues during different stages of disease. Another important consideration is the existence of a species barrier for infection, which could be attributed to a reduced affinity of a given viral agent to PrP^{C} of a different host species. But probably the strongest argument in favor of a viral agent is the existence of different, mutable "strains." Bruce and Dickinson [8] reported several distinct “strains” of the scrapie agent, each with its own characteristic properties, with respect not only to the incubation period length, but also to the pattern and distribution of brain pathology. The properties of these strains remain unchanged by repeated passage in the same mouse strain, with homozygous PrP gene, indicating the existence of genetic information specific for each strain. These findings, coupled with occurrence of considerable mutations, suggested that the agent of scrapie has an independent, replicating genome, and that it could be a small virino (nucleic acid molecule coated by host protein) that awaits discovery. If true, that “virino” must be highly unconventional not only in terms of its size, which is apparently smaller than the size of any known virus or viroids [33], but also in terms of its resistance to treatment with nucleases and other nucleic acid modifying agents. Those in favor of the virino hypothesis argue that the size of the nucleic acid doesn’t have to be large, since it doesn’t have to code for any protein, while its unusual resistance to nuclease-modifying agents - such as nucleases, hydroxylamine and psoralins – can be due to the protective effect of its host-derived coat.

Fig 1: Prion Hypothesis: Prion diseases are caused by accumulation of abnormal isoform of prion protein in neurons. This abnormal, protease resistant protein or PrP^{SC} is formed as a result of post-transcriptional change in the conformation of a normal, protease-sensitive cellular prion PrP^{C}. Either exposure to PrPSC from an outside source or germline or somatic mutation in the PrP gene induces this conformational change. Adapted from Jackson [31].

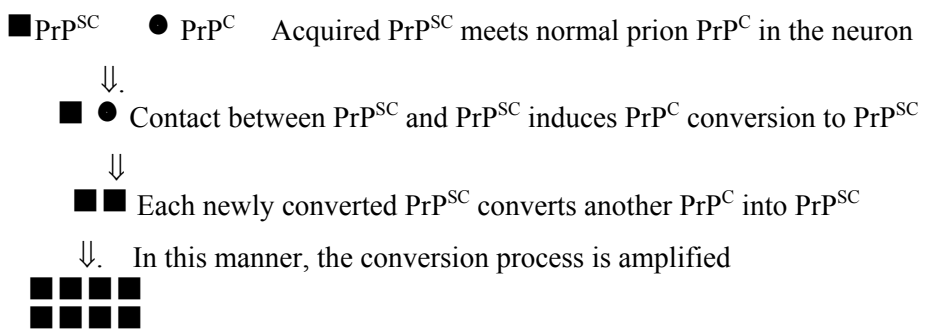


Fig 2: Prion Hypothesis: If harmful prion PrP^{SC} comes in contact with normal cellular prion PrP^{C} in the neurons, it induces PrP^{C} to change its conformation to PrP^{SC} conformation. The newly transformed PrP^{SC} in turn induces another PrP^{C} molecules to change conformation. A chain reaction occurs leading to accumulation of large amounts of PrP^{SC} in the neurons, and destroying them and causing disease. Adapted from: Annon. [20].

2.2. *Virus/Virino Hypotheses*:

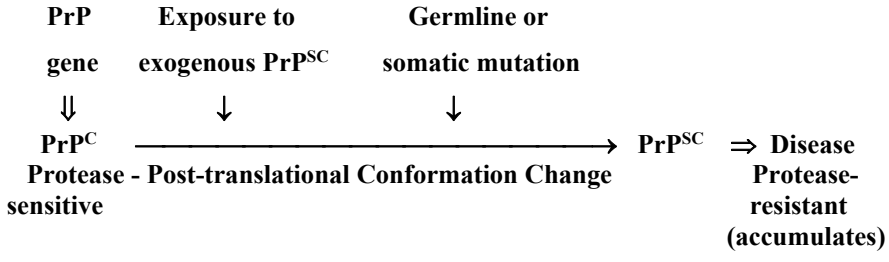
Although the prion hypothesis has been accepted by most biologists, it is not universally accepted, since it represents a major deviation from the biological dogma that nucleic acids are essential for protein synthesis and replication of infectious agents [20]. Many biologists therefore believe that the search should continue for an unconventional virus, or rather a virino[2], as the cause of prion disease should continue.

[2] The virino hypothesis replaced the virus hypothesis following studies suggesting that the average size of nucleic acid per "infectious unit" is not more than 80 nucleotides (Kellings et al., 1992).

normal PrP gene developed the disease only after injecting PrP^{SC} into their brains. On the other hand, when the PrP gene was removed, the animals could not develop prion disease if injected with PrP^{SC} into their brain. When neurons that make up PrP^{C} were grafted into these mice whose PrP gene had been knocked out, and the mice then inoculated with the scrapie agent, their susceptibility was re-established; the grafted tissue became filled with degenerative neurons while the rest of the brain remained unaffected [7; 30]. These experiments suggested that whether a host will develop prion disease or not depends *both* on exposure to the abnormal prion, and the presence of the PrP gene.

Additional support for the prion hypothesis comes not only from the fact that PrP^{SC} fibrils are invariably found in all prion diseases, but also from observations that the quantity of PrP^{SC} is proportional to the severity of the condition, and that the more the PrP^{SC} preparation is purified, the more infective it is [20]. Furthermore, while the infectivity of PrP^{SC} is not affected by different types of disinfection that destroy microbes nor by nucleases that digest nucleic acids, the infectivity can be reduced by substances that cause protein denaturation such as strong alkalis. Furthermore, when PrP^{SC} is denatured and then renatured, it regains infectivity [2]. Additionally, prion disease patients do not show features commonly found in viral infections such as fever, significant inflammatory changes, inclusion bodies or immune response. On the other hand, in all cases of hereditary prion diseases like GSS or FFI and inherited CJD, the patients have the mutant gene that produces PrP^{SC}. In total, these inherited forms make up 25% of all prion cases [15].

PRION HYPOTHESIS



for their survival, though this argument is countered by observations that mice did not sustain harmful consequence for up to 500 days after knocking out their PrP gene [5].

In prion disease, the conversion of PrP^{C} into PrP^{SC} is a post-transcriptional event that occurs either as a result of acquiring PrP^{SC} molecules via some form of horizontal transmission, or as a result of mutation in the gene responsible for prion production (Fig 1). According to Prusiner [14], whenever a PrP^{SC} molecule comes in contact with a PrP^{C} molecule in the neuron, it induces the PrP^{C} molecule to change its conformation into a PrP^{SC} conformation, and the newly formed PrP^{SC} molecule, in turn, induces another PrP^{C} to change conformation, and so on. This chain reaction mechanism of refolding allows the abnormal prion to "replicate" without need for specific nucleic acids (Fig 2). It is also possible that infection with the abnormal prions speeds up nucleation-dependent polymerization of the protein molecules, leading to rapid production of PrP^{SC}. Both the refolding and polymerization models involve direct interaction between PrP^{C} and PrP^{SC}. In the refolding model, the conversion of PrP^{C} into PrP^{SC} is catalyzed by the formation of PrP^{C}-PrP^{SC} heterodimer. In the polymerization model, the rate determining step is the formation of a nucleus of polymerized PrP^{SC}, and once that nucleus is formed, it promotes further polymerization [14; 28; 29]. As these insoluble, enzyme-resistant PrP^{SC} molecules accumulate in increasing quantities in brains cells, they destroy the cells. When the cells are destroyed, the PrP^{SC} molecules are released and could enter and destroy new cells.

As stated earlier, PrP^{SC} formation can also be induced by mutations in the PrP gene. These mutations occur in the open reading frame (ORF)[1] of the gene and have been found in all families with inherited prion diseases; the mutations are believed to initiate the disease by destabilizing one or more α-helices of PrP^{C}, leading to its conversion to PrP^{SC}, which then replicates in the manner described above [25]. Studies on genetically engineered mice showed that mice into which the mutant gene was transferred developed prion disease spontaneously, whereas mice with

[1] Open reading frame (ORF) of a DNA segment is a potential protein sequence identified by an initiator codon in a frame with a chain terminating codon. Special computer programs are used to search for these sequences.

on the physical, chemical, biochemical and molecular properties of PrP, and its genetics and mode of replication. These studies suggested that the development of prion diseases involved structural modification of a harmless, naturally occurring PrP^{C} into the harmful PrP^{SC} version [2; 12-19]. A year before Prusiner's original paper proposing that the scrapie agent was a prion protein was published [12], Merz, at the Institute for Basic Research on Developmental Disabilities, Staten Island, New York, reported that brains of scrapie infected mice contained strange fibrils [20]. The occurrence of error in protein folding was also mentioned by Griffith since 1967, when he wrote: "perhaps a protein that wouldn't normally adopt a particular folding pattern could be catalyzed to do so by a protein that had already assumed that shape" [5]. However, it was Prusiner who pursued this concept and performed extensive studies to support it, work that convinced many biologists and gained him the Nobel Prize.

According to the prion hypothesis, all TSE's or prion diseases are protein conformation disorders leading to accumulation of PrP^{SC} in the brain. The PrP protein is a sialoglycoprotein that occurs on the surface of neurons and other cells [21]. It is held to the cell surface by a glycophosphoinositol or GPI. Its function is not precisely known, but it is probably involved in the work of synapses as well as copper binding and cell signaling [1; 22]. PrP is encoded by a chromosomal gene that seems to be highly conserved, since it is found in diverse organisms ranging from fungi and insects to human beings. In humans, this gene is found in the short arm of chromosome 20 [23]. The normal and harmful types of prion protein are isoforms with the same amino acid sequence, but differing in conformation. The structure of PrP^{C} is composed predominantly of lengthy coils known as α-helices, with no β-pleated sheets, while the amino acids in PrP^{SC} molecules are folded into β-pleated sheets, with very low α-helix content [24-27]. In contrast to PrP^{C}, the PrP^{SC} molecules tend to form insoluble aggregates and fibrils in the brain that resist proteases, and these aggregates and fibrils are the cause of neuronal destruction. It is not known precisely how the misfolded prion damages the neurons, apart from accumulating in them, but one possibility is that it is toxic. Another possibility is that it deprives neurons from PrP^{C}, which could be essential

evidence in this regard being the existence of several, distinct mutable "strains" of the scrapie agent, with different incubation periods and different pathology, which implies the existence of genetic information in a nucleic acid of the infectious particles [8; 9]. Accordingly, there are now two main hypotheses regarding the agent(s) of prion diseases: prion hypothesis and virino hypothesis (virino is a small strand of infectious nucleic acid wrapped in protein). In recent years, a third hypothesis, chaperone hypothesis, has also emerged, which considers the prion to be a molecular chaperone that becomes spontaneously misfolded [10]. There are several other less popular hypotheses on the etiology of prion diseases.

2.1. ***Prion Hypothesis*:**

Prion diseases have three peculiar features: (i) they are caused by an infectious agent that does not seem to require a nucleic acid to replicate (ii) they are both infectious and inherited and (iii) the causative agent has an unusually high resistance to heat, desiccation, freezing, stomach acid, pH changes and various other chemical and physical methods that are normally used to destroy viruses, bacteria and fungi.

The idea that the agent might be a protein capable of replication in the absence of nucleic acid dates back to the 1960's, when Tikvah Alper - a British microbiologist at Hammersmith Hospital - and her colleagues exposed the brains of scrapie-infected mice to ultraviolet radiation. She used UV doses sufficient to destroy nucleic acids, and found that the irradiation did not abrogate the infectivity of the brain tissue. Accordingly, she proposed that scrapie and other related diseases such as Kuru might be caused by an agent that did not require nucleic acid for replication [11]. At that time, her views were ridiculed because it was unconceivable that an infectious agent could replicate without either RNA or DNA. Fifteen years later, Alper's idea was revived by Prusiner [12], who described novel properties for the "scrapie agent" that distinguish it from viruses, plasmids and viroids. Prusiner showed that the scrapie agent was indeed highly resistant to all known procedures of nucleic acid inactivation, while losing its infectivity as a result of treatment with protein denaturing procedures. He proposed the new term "prion" for the scrapie-agent in order to denote its proteinaceous and infectious nature, while distinguishing it from viruses. Since then, Prusiner and his colleagues have conducted extensive research

(PrP^{res}). The presence of this abnormal protein distinguishes prion diseases from other brain diseases that cause dementia such as Alzheimer disease [5].

Though the nature of the infectious agent of prion diseases has not yet been definitively proven, the idea that PrP^{SC} itself is responsible both for the infectivity and pathogenesis of these diseases is widely accepted, and that is why they are now more commonly referred to as “prion diseases.”

Nature of Prion Disease Agent(s)

Prions are defined as "*small, proteinaceous infectious particles that resist inactivation by most procedures that inactivate nucleic acids"* [6]. The resistance of these proteins to nucleases, enzymes that digest nucleic acids, and irradiation, suggests that they lack a nucleic acid genome. In other words, the protein alone is the infectious agent. This protein is highly resistant to protease K, in contrast to its isoform that occurs naturally in the neurons and many other cells types and is readily digested by protease K. The harmful, K-protease resistant form of the prion protein has been named PrP^{SC} or PrP^{res} [7], while the harmless, naturally occurring counterpart is named PrP^{C}, the superscripts are used to distinguish the type of prion: “SC” refers to "scrapie" or "scrapie-like”, “res” refers to “protease-resistant” and “C” refers to "cellular" [5]. In this review, we shall use PrP^{C}, for the harmless and PrP^{SC} for the harmful isoforms of prion protein.

2. Prion Disease Theories:

Originally, prion diseases were believed to be caused by unidentified slow viruses; this was based on the infectious nature and filterability of the putative etiologic agent. However, all attempts to demonstrate virus or virus specific nucleic acid, including the use of subtraction hybridization analysis techniques, have failed to find a nucleic acid in scrapie-infected brains that is not found in normal brain [5]. On the other hand, evidence of the prion hypothesis is becoming increasingly more convincing and many biologists have now accepted that a modified prion protein (PrP^{SC}) alone is the cause of these diseases, and that modified protein could replicate without the presence of nucleic acid. Others, however, are still questioning the validity of this hypothesis, and believe that the so-called “prion” does have an independent genome that is yet to be discovered, the most important

Prion diseases are a group of peculiar degenerative disorders of the brain affecting man and animals. They are widely believed to be caused by a modified, "infectious" version of an apparently ubiquitous cellular protein known as prion protein (PrP). Prion diseases are also known as “transmissible spongiform encephalopathies” (TSE) because although some of them are inherited, all of them can be transmitted experimentally by inoculation or ingestion of infected material. Once the genetic form of the disease arises, the victim's brain becomes "infectious" as well. Therefore, prion diseases are both infectious and inherited – in fact; they are the only known diseases that combine these two attributes. A less commonly used name for prion diseases is transmissible cerebral amyloidoses (TCA) [1].

Prion diseases are generally characterized by a long incubation period, usually measured in years, a relatively short clinical course, and a 100% mortality rate. Almost invariably, they cause dementia, loss of motor control, paralysis and ultimately death [2]. Microscopic examination of the brain shows different degrees of degeneration of the brain tissue, with presence of spongiform intracytoplasmic neuronal vacuolations and loss of neurons, especially in the cerebellum and cortical areas of the brain stem. These changes are accompanied by extensive microglial activity and proliferation of astrocytes - cells responsible for support and repair in nervous system - in the affected regions [3]. The activated microglial cells release inflammatory mediators, including prostaglandins and free radicals, which may enhance neuronal damage. Pocchiari [4] reported that CSF samples from patients with Creutzfeldt-Jakob disease (CJD) contained increased levels of prostaglandin E2 (PGE2) and 8-epi-PGF2, as compared to patients with non-inflammatory neurologic disorders, indicating the occurrence of inflammation and oxidative stress in CJD. This author also reported a short survival in CJD patients with high CSF levels of PGE2, suggesting that the inflammatory response is correlated with the clinical duration of the disease [4].

A common feature of all prion diseases is the presence of fibrils or plaques of an abnormal protein in and around the brain cells [5]. These fibrils were previously referred to as scrapie-associated fibrils (SAF) but following elucidation of their chemical nature, they are now called prion protein of the scrapie type (PrP^{SC}) or protease resistance prion protein

A Review Article

Prion Diseases : (I) The Etiology of Prion Diseases

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Abstract:

Prion diseases or transmissible spongiform encephalopathies (TSE's) constitute an unusual group of progressive neurodegenerative disorders of man and animals characterized clinically by dementia, neurologic and motor disturbances, and ultimate fatality, and pathologically by neuronal vacuolations, gliosis and astrocytosis in the brain tissue. These diseases are peculiar in that they are both infectious and inherited, and are the only known diseases believed to be caused by an "infectious" protein. That protein is a protease-resistant, insoluble prion protein capable of replicating in neurons in the absence of nucleic acid; it is referred to as the "prion protein of scrapie," or PrP^{SC} , and is believed to arise as a result of misfolding of its normal counterpart in the cells, PrP^{C}.

Prion diseases have come into prominence following overwhelming outbreaks of bovine spongiform encephalopathy (BSE) in the U.K., and subsequent diagnosis of the so-called variant Creutzfeldt-Jakob disease, a zoonotic version of BSE, in numerous human victims. A voluminous amount of research into prion diseases has since been published.

Although the prion model is currently the most favoured etiologic model of these diseases, several other hypotheses have been forwarded to explain the nature of the causative agent(s), including "virus," "virino," "chaperone" and "lysosomal storage disease" hypotheses. None of these hypotheses has so far been conclusively proven or ruled out. In part I of this review, the current status of knowledge on the etiology of prion diseases and the different hypotheses of possible etiologic agent(s), with special emphasis on the nature of prions, are discussed. In part II, the clinical and pathological aspects of prion diseases affecting man and animals, and the advances in their diagnosis and treatment, are described.

Introduction

تأثير مواعيد الزراعة والأسمدة المركبة على النمو والانتاج وجودتة فى البصل الحساوى تحت ظروف منطقةالاحساء

محمد بن عبد العزيز العبد السلام و على فتحى حمايل

كلية العلوم الزراعية والاغذية – جامعة الملك فيصل

الأحساء - المملكة العربية السعودية

أجريت تجربة حقلية خلال عامى 2001/2000,2000/1999 لدراسة تأثير ثلاثة مواعيد زراعة (20 سبتمبر ، 20 اكتوبر ، 20 نوفمبر) و أربع معدلات مختلفة من الاسمدة المركبة (20٪ N+20٪ P+20٪ K ; 19٪ N+29٪ P+11٪ K ; 14٪ N+38٪ P+10٪ K ; 16٪ N+9٪ P+26٪ K) على النمو الخضرى والمحصول وجودتة والمحتوى المعدنى فى البصل الحساوي ومحتوى الأوراق من الكلوروفيلات أ ،ب. وقد اشارت نتائج هذة الدراسة الى الآتى :

أعطى ميعاد الزراعة فى 20 اكتوبر أفضل نتائج فى النمو الخضرى والمحصول بالمقارنة بالمواعيد الأخرى بينما أعطى التسميد بالسماد المركب (14٪ N+38٪ P + 10٪K) افضل النتائج فى النمو الخضرى ومحصول الابصال بالمقارنة بالاسمدة الأخرى. أشارت النتائج الى وجود فروق معنوية فى النمو الخضرى والمحصول وجودتة بين المعاملات المختلفة (مواعيد الزراعة والتسميد). أعطى التفاعل بين المعاملة بالزراعة فى 20 أكتوبر والتسميد (14٪ N+38٪P +10٪ K) أفضل النتائج بالنسبة لكلا من عدد الأوراق للنبات ،المساحة الورقية للنبات ،الوزن الجاف/الوزن الطازج للنبات ٪ ، متوسط وزن البصلة بالجم، محصول الأبصال بالكجم للمتر المربع ،شكل البصلة ومحتوى النبات من N,P,K ومحتوى كلوروفيل أ وكلوروفيل ب بالمقارنة بالمعاملات الأخرى.

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Table (9)

Effect of planting dates and compound fertilizer on N. P. and K. in onion bulb and chlorophyll A and B in the onion leaves,during 1999/2000 and 2000/2001

Treatments		N %	P %	K %	Chlorophyl . a (mg/g F.W)	Chlorophyl b (mg/g F.W)
D1	F1	1.66	0.330	0.163	0.303	0.266
	F2	1.71	0.586	0.170	0.390	0.386
	F3	1.77	0.620	0.183	0.376	0.380
	F4	1.66	0.610	0.153	0.360	0.380
D2	F1	2.13	0.356	0.176	0.286	0.260
	F2	2.03	0.593	0.173	0.380	0.388
	F3	2.53	0.643	0.186	0.396	0.383
	F4	2.03	0.620	0.173	0.360	0.353
D3	F1	2.23	0.376	0.166	0.263	0.253
	F2	2.30	0.440	0.163	0.383	0.376
	F3	2.43	0.526	0.166	0.373	0.356
	F4	2.03	0.503	0.153	0.356	0.343
L.S.D.0.050		0.23	0.02	0.01	0.01	0.01

F1 = 20% N, 20% P, 20% K. F2 = 19% N, 29% P, 11% K.
F3 = 14% N, 38% P, 10% K. F4 = 16% N, 9% P, 26% K.
D1 = 20th September D2 = 20th October D3 = 20th November

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	F4	12.33	788.33	24.66	7.26
L.S.D. 0.050		1.17	28.63	2.43	N.S

F1 = 20% N, 20% P, 20% K. F2 = 19% N, 29% P, 11% K.
F3 = 14% N, 38% P, 10% K. F4 = 16% N, 9% P, 26% K.
D1 = 20th September D2 = 20th October D3 = 20th November

Table (8)

Effect of planting dates and fertilizer on bulb weight bulb yield, bulb shape index and double/normal bulb %, during 1999/2000 and 2000/2001.

Treatments		Bulb weight gm	Bulb yield kg/m^2	Bulb shape index	No. of double/ No. of bulb %
D1	F1	177.66	2.36	7.500	16.16
	F2	187.33	2.86	7.86	17.00
	F3	195.00	2.23	8.26	14.00
	F4	180.66	2.80	8.03	15.33
D2	F1	184.00	2.76	7.40	13.70
	F2	186.66	2.73	7.86	14.06
	F3	205.00	3.50	8.30	12.23
	F4	186.33	2.60	8.13	13.26
D3	F1	176.66	2.40	7.26	15.30
	F2	183.66	2.86	8.20	14.40
	F3	192.33	3.100	7.86	12.96
	F4	180.00	2.73	7.43	14.16
L.S.D.0.050		5.17	0.16	0.13	N.S

F1 = 20% N, 20% P, 20% K. F2 = 19% N, 29% P, 11% K.
F3 = 14% N, 38% P, 10% K. F4 = 16% N, 9% P, 26% K.
D1 = 20th September D2 = 20th October D3 = 20th November

and fertilization in the measured parameters. Comparable results were obtained by Al-Madini *et al* (2000) who found that N, P, and K contents in the onion plants increased after the application of NPK fertilizer, while Hamaiel, *et al*. (1995) mentioned that calcium nitrate at 100 kg N/feddan significantly increased chlorophyll a and b in table beet.

In conclusion, Hassawi onion plants showed differential response to different planting dates and different types of NPK compound fertilizers. Best response, as observed by the vegetative growth and yield quality parameters of Hassawi onion, was obtained when planting in 20 October with F3 fertilizer (14% N, 38% P, 10% K). However, the 14% N, 38% P, 10% K fertilizer with 20 October gave better results than the other treatments, which leads us to recommend the former fertilizer for Al-Hassawi onion plants under the dry conditions of Al-Hassa region.

Table (7)

Effect of planting dates and compound fertilizers on leaves/plant, leaf area, dry/fresh weight and neck shape index during 1999/2000 and 2000/2001.

Treatments		Number of leaves/plant	Leaf area (cm^2/plant)	Dry/fresh weight (%)	Neck shape index
D1	F1	13.66	1222.66	28.83	6.30
	F2	13.83	1125.33	29.33	6.86
	F3	15.50	1419.66	30.00	7.10
	F4	12.83	960.33	27.66	7.16
D2	F1	15.50	1472.66	27.33	6.30
	F2	16.50	1377.00	27.83	6.73
	F3	17.50	1773.00	30.66	6.30
	F4	13.00	1035.66	26.50	6.53
D3	F1	13.00	973.66	26.50	7.30
	F2	12.50	788.33	25.00	7.40
	F3	14.50	1117.00	26.00	7.10

L.S.D. 0.050	0.15	0.02	0.02	0.01	0.06

F1 = 20% N, 20% P, 20% K. F2 = 19% N, 29% P, 11% K.
F3 = 14% N, 38% P, 10% K. F4 = 16% N, 9% P, 26% K.

Interaction between planting dates and compound fertilizers:

The interaction effects between dates and fertilization,on plant growth parameters were significant (Table 7). The best results of nitrogen, phosphorus and potassium contents were obtained in onion bulb and chlorophyll a, and b in the leaves during the two cropping seasons. Highest mean values of leaves/plant, leaf area/plant and dry/fresh weight %, were obtained for 20 October with F3 (14% N, 38% P, 10% K), while the highest value for neck shape index was obtained 20 November with F2 (19% N, 29% P, 11% K). The results agree with those obtained, Rizk (1997), Vachhanni and Patel (1993), and El-Marabaa *et al* (1975), Who reported similar results on onion plants.

Yield and yield quality:

Data in table (8) summarized the effect of planting dates and fertilization on onion yield and its quality. The highest mean value of average bulb weight, bulb yield m^2 and bulb shape index were obtained for 20 October with F3 (14% N, 38% P, 10% K) treatments. While the highest value of double/normal bulb % was obtained with 20 September with F2 (19% N, 29% P, 11% K). Similar results were obtained by Patel and Vachhanni (1994) who reported that onion bulb diameter, weight and yield increased with application of 150 kg N ha^{-1} and 75 kg P_2O_5 ha^{-1}, Pandey and Ekpo (1991), Farrage (1983). Jayabharathi (1989) also reported similar results on onion yield.

N, P and K contents in onion bulb and chlorophyll a and b in onion leaves:

Table (9) indicate the effect of different planting dates and different fertilizers on mineral content of bulb and chlorophyll a and b in onion leaves.

The best results for N%, P%, K% contents of bulb and chlorophyll a were obtained for 20 October with F3 (14% N, 38% P, 10% K), while chlorophyll b was the highest for 20 October with F2 (19% N, 29% P, 11% K). Date also show that there were significant differences between dates

Yield and yield quality:

Table (5) indicated that the highest mean values for bulb weight, bulb yield, and bulb shape index were obtained after using F3 (14% N, 38% P, 10% K), while F2 (19% N, 29% P, 11% K) treatment gave the highest mean values for double/normal bulb (1%) in both seasons. There were significant differences among all yield and quality parameters under different fertilizer types. These results are in correspondence with the findings of Jayabharathi (1989) who observed that best yield of onion bulb was obtained by applying NPK at the rate of 75 kg ha^{-1}. Al-Madini *et al.* (2000) mentioned that NPK fertilizer gave the highest yield of onion bulb under Al-Hassa region. Singh, *et al*. (1989) found that application of 120 kg N and 50 kg K_2O ha^{-1}, gave the best onion bulb and bulb shape index. Vachhanni and Patel (1993), Patel and Vachhani (1994) and Pandey and Ekpo (1991), also reported similar results.

Table (6) shows the effect of different fertilizers types on the mineral composition of onion bulb and chlorophyll a, b in the leaves. Data showed that there were significant differences among different fertilizer treatments . The N, P Kand chlorophyll a and b contents were significantly higher in F3 (14% N, 38% P, 10% K), and the lowest in F4 (18% N, 9% P, 26% K) except P % which was the lowest value with F1 (20% N, 20% P, 20% K) treatment

Table (6)

Effect of compound fertilizer on N. P. and K. contents in onion bulb and Chlorophyla ,b in onion leaves, during 1999/2000 and 2000-2001.

Treatments	N %	P %	K %	Chlorophyl,a (mg/g F.W)	Chlorophyl,b (mg/g F.W)
F1	2.00b	0.35c	0.168b	0.284c	0.260d
F2	2.01b	0.54b	0.168b	0.382a	0.373b
F3	2.24a	0.59a	0.178a	0.384a	0.383a
F4	1.91c	0.54b	0.160c	0.352b	0.358c

Table (4)

Effect of compound fertilizer on leaves/plant, Leaf area, dry/fresh weight %., neck shape index during 1999/2000 and 2000/2001

Treatments	No. of leaves/ plant	Leaf area (cm^2/ plant)	Dry/fresh Weight (% /plant)	Neck shape index
F1	14.05b	1223.00 b	27.55b	6.63c
F2	14.27 b	1096.88c	27.38b	7.00a
F3	15.83 a	1436.55a	28.88a	6.83b
F3	15.83 a	1436.55a	28.88a	6.83b
F3	15.83 a	1436.55a	28.88a	6.83b
F4	12.94 c	928.11d	26.27c	6.98b
L.S.D. 0.050	0.67	16.53	1.40	0.08

F1 = 20% N, 20% P, 20% K. F2 = 19% N, 29% P, 11% K.
F3 = 14% N, 38% P, 10% K. F4 = 16% N, 9% P, 26% K.

Table (5)

Effect of compound fertilizer on bulb weight ,bulb yield, bulb shape index, and double/normal bulb, during 1999/2000 and 2000/2001

Treatment	Bulb weight (gm)	Bulb yield (Kg/ m^2)	Bulb shape Index	D/N Bulb %
F1	179.44d	2.577d	7.38d	15.055a
F2	185.88b	2.822b	7.97b	15.155b
F2	185.88b	2.822b	7.97b	15.155b
F3	197.44a	3.277a	8.14a	13.066a
F4	182.33c	2.711c	7.86c	14.255c
L.S.D. 0.050	2.99	0.10	0.07	0.58

F1 = 20% N, 20% P, 20% K. F2 = 19% N, 29% P, 11% K.
F3 = 14% N, 38% P, 10% K. F4 = 16% N, 9% P, 26% K.

D1 = 20th September D2 = 20th October D3 = 20th November

Table (3)
Effect of planting dates on N,. P,. K, andChlorophyll. a,b contents of onion bulb, during 1999/2000 and 2000-2001

Treatments	N %	P %	K %	Chlorophyl,a (mg/g F.W)	Chlorophyl,b (mg/g F.W)
D1	1.70 c	0.53b	0.17 b	0.35 b	0.34 b
D2	2.25a	0.55 a	0.18 a	0.36 a	0.35a
D3	2.18b	0.46 c	0.16 c	0.33 c	0.33c
L.S.D.0.050	0.12	0.01	0.01	0.01	0.01

D1 = 20th September D2 = 20th October D3 = 20th November

Effect of fertilizer types on onion plant vegetative growth :

Table 4 reveals the vegetative growth parameters (number of leaves/plant, leaf area plant (cm^2), dry/fresh weight % and neck shape index of the onion plants as affected by the fertilizer treatments. All the growth parameters increased significantly with F3 (14% N, 38% P, 10% K) than the other fertilizers treatments except the neck shape index which was significantly higher in F2 (19% N, 29% P, 11% K). This probably may be due to higher phosphorus contents of F3 than the other fertilizers. The results are in agreement with those obtained by Rizk (1997) who concluded that increasing the application rate of NPK fertilizer increased growth parameters of onion plant. Similarly, Vachhani and Patil (1993) found that plant height, and number of leaves/plant were the highest with the application of 150 kg N ha^{-1}. Pandey and Ekpo (1991) found that the application rate of 160 kg N ha^{-1} produced tall plant and high number of leaves/plant. Al-Madini *et al* (2000) found that increasing the application of NPK fertilizer significantly increased the plant growth.

different effects on Al-Hassawi onion plant. This is in line with the data suggested by different investigators, who also observed that the N, P and K and chlorophyll a and b contents of AL-Hassawi onion plant, increased when planted on 20 October (El-Marabaa *et al* 1975).

Table (1)
Effect of planting date on vegetative growth parameters of Hassawi Onion during 1999/2000 and 2000/2001

Treatments	leaves/plant (No)	Leaf area (cm^2)	Dry/fresh Weight/plant (%)	Neck bulb (cm)
D1	13.95 b	1182.00 b	27.91 b	6.85 b
D2	15.79 a	1414.58 a	29.12 a	6.46 c
D3	13.08 c	916.83c	25.54 c	7.26 a
L.S.D.0.050	0.54	14.32	1.22	0.07

D1 = 20th September D2 = 20th October D3 = 20th November

Table (2)
Effect of planting dates on yield and yield compounents of Hassawi Onion during 1999-2000 and 2000-20001

Treatments	Average bulb Weight (gm)	Bulb Yield (kg/m^2)	Bulb shape index	No .of double/ Normal/bulb (%)
D1	185.16 b	2.86 b	7.91 b	15.62 a
D2	190.50 a	2.90 a	7.92 a	13.31 c
D3	183.16 c	2.77 c	7.69c	14.20 b
L.S.D. 0.050	2.54	0.08	0.06	0.50

Results and discussion

Vegetative growth

Mean values of different plant growth parameters ranged from 13.08-15.79 (leaves/plant), 916.83-1414.58 cm^2 (leaf area), 25.54-29.21cm^2 (dry/freash weight/plant) and 6.47-7.27% (neekshapeindex) in different planting dates (Table1). The plant growth parameter increased significantly for October than September and November planting dates, except neek shape index which was significantly higher for Novemberthan other planting dates (L.S.D 0.05 value given in table 1). The significant higher growth in October could be due top moderate climatic condition than either September (being relatively hot) or November (being relatively cool) months. Because extreme climatic. Conditions during September and November, might have advancly affected the condition and plant growth than October plantation. Similar results are observed by other investigators. Farrage (1983) who found the best vegetative growth of crop when transplanted after 1st September as compared to1st October under Egypt condition.

Yield and yield quality

Mean yield and yield quality parameters are given in table (2) which includes the average bulb weight (gm) bulb yield/m^2, bulb shape index and number of double/normal bulb %. It was found that 20th October planting date caused significant differences in the measured parameters of yield and yield quality as compared to the other planting dates except double/normal bulb % which was highest for 20 September date. This proposes that 20th September is the optimum to obtain the highest yield and best quality of onion plants in the Al-Hassa region. The results of this study agree with those obtained by El-Marabaa *et al.* (1975) who found that the highest bulb yield and quality were obtained after seedling 15 October as compared to that of 15 September and 15 November under Egypt condition.

Mean condition of N, P and K in the onion bulb and pigments in the leaves are shown in Table 3. The N, P and K contents in the onion bulb and chlorophyll a and b, in leaves increased with using 20 October than other dates. There were significant differences among different planting dates. This finding corresponds well with the vegetative growth and yield parameters obtained in this study, suggesting that the different dates caused

Data obtained were subjected to approprite statistical analysis (Gomez and Gomez 1984).

A field experiment was carried out at the Agricultural and Veterinary Training and Research Station, King Faisal University, Al-Hassa, KSA during 1999/2000 and 2000/2001. Forty five days onion seedling (AL-Hassawi cultivar) were used in this study . The experiment was conducted on a sandy soil (96% sand, 4% silt and clay) with low salinity (EC 1:2.5 = 1.6 dS m –1), slightly acid conditions (PH 1:2.5 = 7.50) and relatively low of CaCO3 (7%). The soil (i.e. the upper 0- 50 cm) contained low total nitrogen (N) and available phosphorus (P) as 0.003 %,and 4.95mg L –1, respectively). Physical and chemical properties of soil were determined by following the methods as described by Rowell (1994).

The evaluated sowing dates were : 20th sept. D1, 20th Oct. D2 and 20th Nov. D3, on both seasons .It should be 1999-2000 and 2000-2001 keeping in view the dates and crop duration .

Onion plants were fertilized with four NPK compound fertilizers at the rate of 714 kg NPK ha L –1. The fertilizer treatments were (20% N, 20% P, 20% K. F1), (19% N, 29% P, 11% K. F2), (14% N, 38% P, 10% K. F3) and 16% N, 9% P, 26% K. F4). A surface irrigation system was used to irrigate plants. The experiment consisted of twelve treatments and four replicates in a split plot design. The main plots were arranged for different planting dates, while the sub-plots, were for the fertilizers. The total area of each plot was 16 m^2 being divided into four rows with 8 m length and 50 cm width. The spacing between the plants was 12 cm. All other common farming practices for the onion in the Al-Hassa oasis were also performed. During the growing period and after harvesting, some plant growth measurements were taken to determine difference in vegetative growth, yield and yield quality as affected by different dates of plantig and the compound fertilizers. The measurements included number of leaves/plant, leaf area (cm^2), dry/fresh weight; plant%, neck bulb (cm), shape bulb index, average bulb weight (gm), total yield kg /m^2,and double/normal bulb. Chlorophyll a, b. were extracted with acetone 80% and measured colorimetrically according to Arnon (1949) in fourth leaf. They were completed on representative samples of 10 plants selected randomly from each plot. The N, P, K, and mineral contents in the Hassawi onion plant were analyzed by following the methods as described by Page, *et al*. (1982).

components of Al-Hassawi onion. Rizk (1997) mentioned that increasing the rate of NPK fertilizers increased vegetative growth parameters and yield of onion bulb. Vachhani and Patel (1993) found that plant height, number of leaves/plant, bulb weight, size and onion yield were highest with the application of 150 kg N ha-1. They also suggested that increasing P application increased the number of leaves/plant and bulb weight, size and yield, but K applications only increased the number of leaves/plant. Pandey and Ekbo (1991) found that P and K alone had no effect on the bulb diameter and yield, while Patel and Vachani (1994) suggested that onion bulb diameter, weight and yield increased with the application of 150 kg N/ha and 75 kg P_2O_5 ha-1, but showed no significant difference from the 150 kg K_2O ha-1. Soto (1989) mentioned that the critical levels for P and K in the soil were 15 mg L^{-1} (by a modified olsed solution) and 7 mg L^{-1}(by a Ca PO_4 solution) respectively. Pandey and Ekpo (1991) found that application rate of 160 kg N ha^{-1} gave a tall plant (63.9 cm) and high number of leaves/plant (13.0), while 120 kg N ha^{-1} produced best average weight and the highest yield of onion bulb. El. Marabaa *et al* (1975) found that the highest bulb yield and quality were obtained after seedling transplanting of 15 October compared with 15 September and 15 November. Farrag (1983) found that the best vegetative growth and bulb yield were obtained after15 September transplanting as compared to 15 October. Jayabharathi (1989) observed that best yield of onion bulb with an average weight of 114 gm was produced by the appling NPK at the rate of 75 kg^{-1}.

Almadini, *et al*. (2000) found that increasing the application of NPK fertilizers significantly increased the growth and yield of onion under Al-Hassa condition. The best values were found with 18 : 7 : 16 NPK fertilizer applied at the rate 714 kg ha^{-1}, which also resulted in the highest values of NPK contents in plants. However, the highest value of double/normal bulb was observed with 18 : 18 : 6 NPK fertilizer applied at the rate of 952 kg ha^{-1}. The highest value of soil NPK contents after harvest were observed under the highest applied rates of both fertilizers. Singh *et al*, (1989) mentioned that the application of 120 kg N and 50 kg K_2O ha^{-1} gave the talest plants, higher number of leaves/plant, best bulb weight, diameter and yield.

Materials and methods

Effect of Planting Dates and Compouned Fertilizers on Growth, Yield and Quality of Hassawi Onion Under Al-Hassa Oasis Conditions

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Abstract:

A field experiment was carried out during 1999-2000and 2000-2001, to study the effect of three planting dates (September 20, October20 and November20) and four compound fertilizer rates (F1= 20% N, 20% P, 20% K .F2=19% N, 29% P, 11% K, F3= 14% N, 38% P, 10% K and F4=16% N, 9% P, 26% K) on vegetative growth, yield, yield quality, mineral composition in bulb onion and chlorophyll a and b in onion leaves. It is concluded from this study that 20 October date and F3 fertilizer Treatment (14% N, 38% P, 10% K) were the most effective for optimal prodution of Hassawi onion. There were significant differences in the vegetative growth yield and yield components between the different planting dates and fertilization. Planting on October 20 gave the better results than other dates, while F3 (14% N, 38% P, 10% K gave the best results for vegetative growth yield,and yield quality. Also 20 October planting date along with 14% N, 38% P, and 10% K gave better results for number of leaves/plant, leaf area/plant, dry/fresh weight%, average bulb weight (gm), bulb yield kgm^2 bulb shape index, N, P,. K chlorophyll a and chlorophyll b contents than other treatments.

Introduction:

Al-Hassawi onion plant (*Allium cepa L.*) is usually grown during winter and spring seasons. It is one of the most popular crops in Al-Hassa region of the Kingdom of Saudi Arabia .Al-Hassa oasis is one of the largest agricultural regions characterized by its arid climate (Al-Taher 1999). Onion plants cover an area of 2060 ha, out of which 824 ha are under irrigated cultivation. The soils of Al-Hassa region usually are low in available nitrogen and phosphorus Al-Barrak (1986).

Previous investigations showed that different compound fertilizers and different planting dates affected the growth characters, yield and yield

تأثير كلوريد الصوديوم ودرجة الحرارة على إنبات ثلاثة أصناف من الكانولا

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كلية العلوم الزراعية والأغذية - جامعة الملك فيصل

الأحساء – المملكة العربية السعودية

نفذ هذا البحث لدراسة تأثير تركيز ملح كلوريد الصوديوم (50، 100، 150، 200 مول/م^3 ، بالإضافة إلى معاملة المقارنة وهي الماء المقطر) ودرجة حرارة تحضين البذور (15،25 ، 35 ^{o}م). على نسبة وسرعة الإنبات لثلاثة أصناف من الكانولا (السرو 4، السرو8، باكتول). وقد دلت نتائج الدراسة أن تركيزات ملح كلوريد الصوديوم في بيئة الإنبات قد أثرت معنويا علي نسبة وسرعة الإنبات، حيث نقصت سرعة ونسبة الإنبات بزيادة مستويات كلوريد الصوديوم عن 100 مول/م^3 .

سجلت أقل درجة حرارة حضنت فيها البذور (15 ^{o}م) أعلى نسبة من الإنبات، في حين سجلت أعلى درجة حرارة (35 ^{o}م) أقل نسبة إنبات. وقد بلغت سرعة الإنبات أقصاها في درجة حرارة 25 ^{o}م .

اختلفت أصناف الكانولا فيما بينها معنويا في سرعة الإنبات ، وقد سجل السرو 8 أعلى سرعة إنبات بينما لم تختلف نسبة الإنبات معنويا في الأصناف الثلاثة وكان صنف الكانولا السرو 8 هو الأعلى من حيث نسبة الإنبات.

وبصفة عامة، يمكن القول أن بذور الكانولا يمكنها أن تنبت بنجاح في درجات حرارة تتراوح من 15 إلى 35 ^{o}م على أن لا تزيد مستويات الملوحة في بيئة النمو عن 100 مول/م^3 كلوريد صوديوم ، وأن نسبة وسرعة الإنبات تنقص كثيرا بزيادة درجة الحرارة في حالة وجود مستويات عالية من ملح كلوريد الصوديوم (150 – 200 مول/م^3 كلوريد صوديوم).

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Fig. (4) Germination speed of canols Cvs in response to NaCl concentration

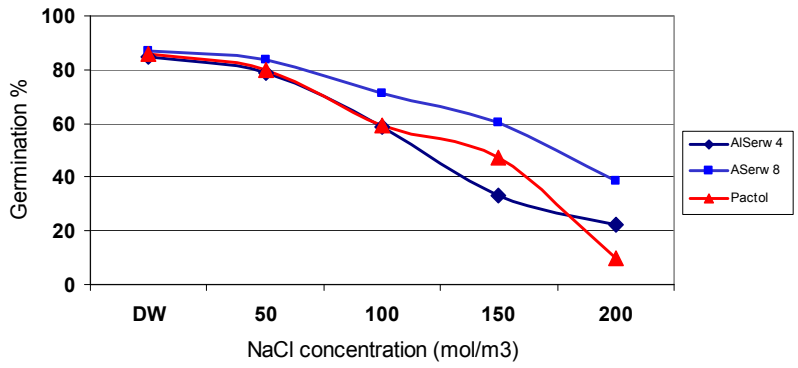


Fig. (2) Germination % in response to NaCl concentration and incubation temperature

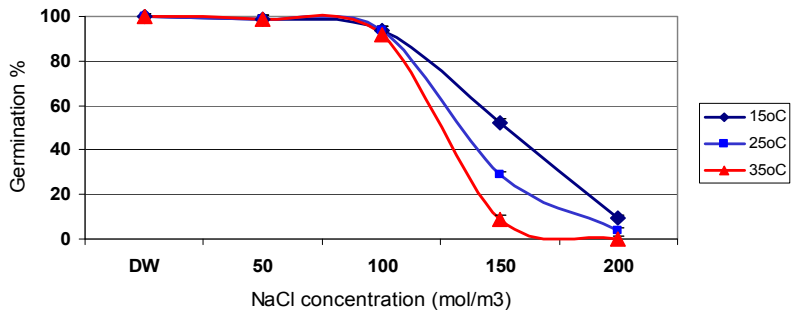
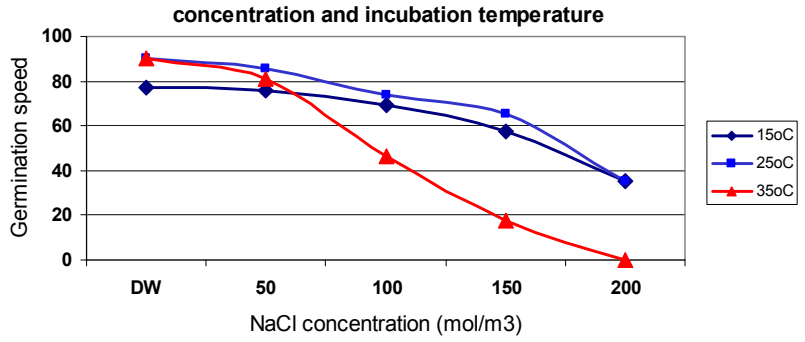


Fig. (3) Germination speed in response to NaCl concentration and incubation temperature



Interaction Effects:

The interaction between salinity concentration and incubation temperature had significant effects on seed germination percentage and germination speed. Data graphically depicted in Fig. (2 and 3) show that the highest reduction in seed germination percentage and germination speed were observed as salinity concentration increased (150 and 250 mol/m^3 NaCl) with the highest incubation temperature degree (35^{o}C). Germination speed of the three evaluated canola cultivars significantly varied among them in response to salinity concentrations. Al-Serw 8 was the best in tolerance to salinity, which surpassed the other two cultivars in germination speed under the highest salinity concentrations (Fig. 4). Pactool CV. was the lowest tolerant in this concern. Other interactions did not induce significant effects on germination percentage and germination speed.

In general, it can be stated that canola seeds can be successfully germinated under the incubation temperature ranging from 15 to 35 ^{o}C in case of low concentration of salinity (up to 100 mol/m^3 NaCl). Seed germination percentage and germination speed decreased with increasing salinity concentration levels beyond 100 mol/m^3 NaCl particularly with increasing incubation temperature.

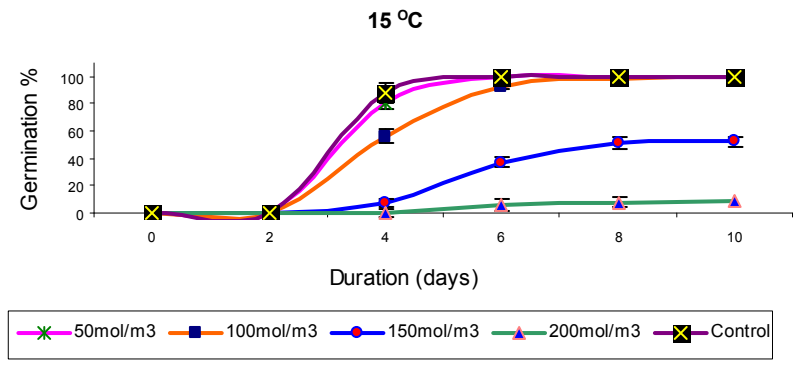
Table (2)
Speed of germination of the evaluated three canola cultivars in response to salinity concentration and incubation temperature

Incubation Temperature	Salinity Levels	Cultivar			Mean
		Al-Serw 4	Al-Serw 8	Pactol	
15 °C	5 dSm	74.8	76.2	77.0	76.0
	10 dSm	66.8	71.7	70.3	69.6
	15 dSm	53.3	61.2	58.0	57.5
	20 dSm	30.0	48.7	26.7	35.1
	Control (DW)	77.3	77.7	77.2	77.4
	Mean	60.5	67.1	61.8	63.1
25 °C	5 dSm	83.2	89.3	85.1	85.9
	10 dSm	68.9	84.2	72.5	74.1
	15 dSm	37.5	75.2	84.2	65.6
	20 dSm	36.7	66.7	3.3	35.6
	Control (DW)	87.0	91.3	92.7	90.3
	Mean	62.0	81.3	67.6	70.3
35 °C	5 dSm	78.7	86.2	78.0	80.9
	10 dSm	43.0	60.7	34.7	46.1
	15 dSm	8.3	43.8	0	17.4
	20 dSm	0	0	0	0
	Control (DW)	89.5	92.3	88.2	90.0
	Mean	43.9	56.6	40.1	46.9
Mean	5 dSm	78.9	83.9	80.1	80.9
	10 dSm	58.6	71.1	59.2	63.3
	15 dSm	33.1	60.1	47.4	46.8
	20 dSm	22.2	38.4	10.0	23.6
	Control (DW)	84.6	87.1	86.0	85.9
	Mean	55.5	68.3	56.5	

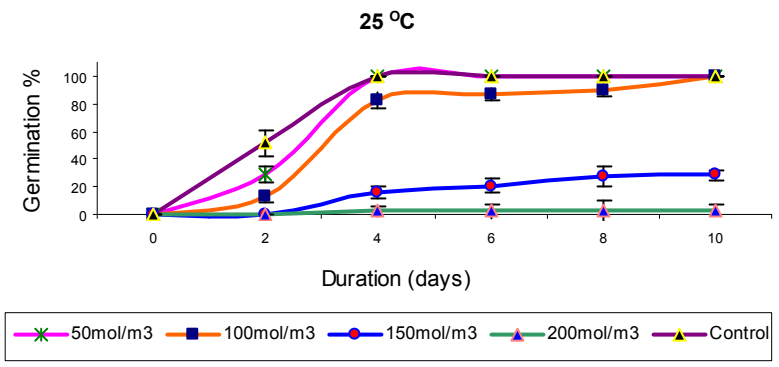
BLSD 0.05 for: Incub.Temp (A) = 4.3
Salinity Conc. (B) = 5.6
Cultivars (C)= 4.3

Fig.(1) : Seed germination of canola seeds as affected by salinity concentrations at 15 (A), 25 (B) and 35 (C) ºC incubation temperature, bars are SD values.

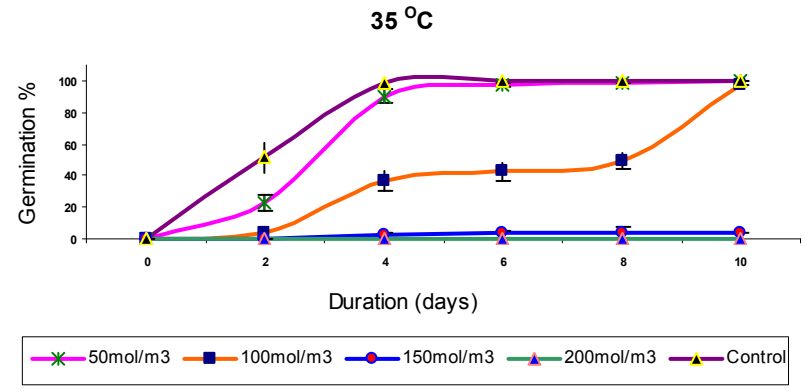
A


15 °C
Germination %
100
80
60
40
20
0
0
2
4
6
8
10
Duration (days)
50mol/m3
100mol/m3
150mol/m3
200mol/m3
Control

B


25 °C
Germination %
100
80
60
40
20
0
0
2
4
6
8
10
Duration (days)
50mol/m3
100mol/m3
150mol/m3
200mol/m3
Control

C


35 °C
Germination %
100
80
60
40
20
0
0
2
4
6
8
10
Duration (days)
50mol/m3
100mol/m3
150mol/m3
200mol/m3
Control

Incubation temperature degree effects:

Results indicated that incubation temperature had significant effects on seed germination percentage and germination speed (Table 1). The lowest incubation temperature degree (15 ^{o}C) was the best which recorded the highest seed germination percentage (72.4 %). Raising temperature degree during seed incubation was associated with a significant decrease in germination percentage. The highest incubation temperature degree (35 ^{o}C) recorded the lowest germination percentage (60.4 %), as shown in Fig. (1). Meanwhile, germination speed reached its maximal value (70.3) with the intermediate incubation temperature, 25 ^{o}C (Table 2). The decrease in seed germination percentage under the higher temperature could be particularly attributed to the exposure of seeds during germination to heat which resulted in malfunctioning of the enzymatic system. This situation would lead to limitation in many physiological process vital for seed germination. Similar results were reported by Nykiforuk and Johnson-Flanagan (1994). Furthermore, higher incubation temperature could increase the ions fulxes via cell membrane, particularly Na and Cl which run the risk of toxicity inhibition to the physiological process of seed germination (Salisbury and Ross, 1992).

Canola cultivar differences:

Statistical analysis of data (Table 1) revealed that there were insignificant differences among the three evaluated canola cultivars in seed germination percentage. However, canola cultivars significantly varied in germination speed. The highest germination speed was observed with Al-Serw 8 CV which markedly surpassed both of Al-Serw 4 and Pactool CVs. Meanwhile, there was insignificant difference between Al-Serw 4 and Pactool CVs in germination speed . This probably represents the genetic resistance to salinity of Al-Serw 8 which could be attributed to the condition under which the cultivar was selected. Puppala *et al.* (1999) found varietal variation in germination percentage of canola seeds.

N.S.: not significant
** : Significant at 0.01% level of probability

wetted with solutions of 50 and 100 mol/m^3 NaCl. The reduction in seed germination was obvious when salinity concentration of seeds media increased to 150 and 200 mol/m^3 NaCl (Fig 1). Similar observations were reported by Maas and Hoffman (1977), Puppala *et al.* (1999) and Houle, *et al.* (2001). Increasing salinity concentration in germination media often cause osmotic and/or specific toxicity which may reduce or retard germination percentage (Waisel, 1972, Mohammed and Sen, 1190 and Basalah, 1991). The response observed with canola up to 100 mol/m^3 was only germination delaying which can be attributed to osmotic effects. Seed germination at 150 mol/m^3 NaCl and more was substantially delayed and reduced. It was quite probable that the delay and reduction in seed germination under these circumstances were equivalently due to osmotic or toxicity effects or a combination of both. Germination speed was significantly affected by media salinity concentration, following the same trend of germination percentage. The faster speed of germination was observed when seeds were wetted with the distilled water. The increase in salinity concentration of media solution resulted in marked decrease in germination speed (Table 2).

Table (1)

Source of variance (S.V), degrees of freedom (D.F), mean squares (M.S) and probability (P) of studied factors for seed germination and germination speed.

S.V	D.F	Seed germination		Germination speed	
		M.S	P	M.S	P
NaCl (A)	4	7303.2	0.0001**	354.0	0.0001**
Incubation Temperature (B)	2	199.5	0.0001**	129.57	0.0001**
Cultivars (C)	2	14.2	0.06 NS	45.92	0.0001**
Interaction (A*B)	8	120.0	0.0001**	30.08	0.0001**
Interaction (A*C)	8	3.9	0.63 NS	8.93	0.0001**
Interaction (B*C)	4	1.71	0.85 NS	4.8	0.067 NS
Interaction (A*B* C)	16	4.25	0.65 NS	5.08	0.070 NS
Experimental Error	225	5.11		2.16	

Materials and Methods:

Seeds of three canola cultivars (Al-Serw 4, Al-Serw 8 and Pactol) were sown on top filter paper in sterilized petri-dishes (7 cm diameter) and wetted with solution of different salinity concentrations (50, 100, 150 and 200 mol/m^3 NaCl), in addition to the control, i.e. distilled water. Petri-dishes were incubated in programmed refrigerated incubators with Sylvania cool-white fluorescent lamps at 15, 25 and 35 ^oC maintained within ±1 °C of target levels. Each treatment was replicated six times in a completely randomized experimental design. Seeds were considered germinated when the radicle was 2 – 3 mm in length. Germination percentage was estimated according to the technique of Standard Germination Test (ISTA, 1993). To estimate germination percentage, germination was counted every two days till 12 days where seeds germinaton were completed.

Germination speed (GS) was calculated according to the formula of McGuire (1962) as follows:

$$GS = \frac{\text{Normal seedlings(No)}}{\text{Days to first count}} + \cdots + \frac{\text{Normal seedlings(No)}}{\text{Days to final count}}$$

Obtained data was subjected to the proper technique of analysis of variance (ANOVA) as published by Gomez and Gomez (1984) and the treatment means were compared using the test of Baysian Least Significant Difference, BLSD, as mentioned by Waller and Duncan (1969). Computations and statistical analysis were done using the facility of computer and SAS software (SAS Institute, 1995).

Results and Discussion :

Salinity concentration effects:

Results of this study reveal that salinity concentrations of media significantly affected seed germination percentage and germination speed (Table 1). It is evident that each increase in salinity concentration after 100 mol/m^3 NaCl was associated with marked reduction in seed germination percentage. There were no significant differences in seed germination percentage between control (seeds wetted with distilled water) and that

increasing salinity levels (Steppuhn and Wall, 1999 and Puppala *et al.*, 1999 and Houle *et al.*, 2001).

Within canola cultivars, there are cultivar differences in sensitivity to salinity. The genetic role in seed germination resistance to salinity is probably one of the most important advantage that can be used in preeding programs. Significant variation in seed germination between canola cultivars grown under salinity condition is widely reported by Zheng *et al.* (1998) and Puppala *et al.* (1999).

The convenient temperature degree may plays an active role in enhancing canola seed germination. Spring canola is sometimes planted when soil temperatures are below the optimum, causing farmers to have stand losses because of seed rotting in cold soil. Knowledge of the growing-degree hours (GDH) required for emergence of canola from different planting depths could help producers decide when and how deep to plant this crop (Vigil *et al.*, 1997). Canola seeds reached 95% germination within 8 days at 10 ^{o}C and displayed rapid seedling growth (Nykiforuk and Johnson-Flanagan,1994 and Zheng *et al.*, 1994). This was associated with high isocitrate lyase activities and rapid mobilization of total lipid and protein reserves. Low temperature has a deleterious effect on the germination of canola and this may be reflected in a loss or a delay of coordination in the mobilization of reserves (Nykiforuk and Johnson-Flanagan, 1994). Seed germination speed was also reported to be stimulated at 10 ^{o}C (Zheng *et al.*, 1994). However, Puppala *et al.* (1999) reported that Germination was severely limited at 5 ^{o}C.The optimum germination temperature occurred in the 15 to 25 ^{o}C range. They also added that the interactions between cultivar and salinity, cultivar and temperature, and cultivar, salinity and temperature had highly significant effects on canola seed germination

The tolerance of canola to salinity during germination however has not been widely reported. Therefore, the objective of this study was to evaluate the germination response of canola to different levels of salinity, incubation temperatures and cultivars, as well as their interactions.

Effect of NaCl and Incubation Temperature on Seed Germination of Three Canola (*Brassica napus* L.) Cultivars

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Abstract:

This investigation was performed to study the effect of NaCl concentration (50, 100, 150 and 200 mol/m^3 NaCl, in addition to the control, i.e. distilled water) and incubation temperature (15, 25 and 35 ^{o}C) on seed germination percentage and germination speed of three canola CVs (Al-Serw4, Al-Serw 8 and Pactol). Salinity markedly affected seed germination percentage and speed of germination. The lowest incubation temperature degree (15 ^{o}C) was the best which recorded the highest seed germination percentage, while the highest incubation temperature degree (35 ^{o}C) recorded the lowest germination percentage. Meanwhile, the moderate incubation temperature (25 ^{o}C) was the highest in germination speed. Evaluated canola cultivars significantly differed in speed of germination. Al-Serw 8 recorded the highest germination speed. On the other hand, a slight and insignificant difference was noticed among cultivars in seed germination percentage, however Al-Serw 8 ranked the first in this concern.

Introduction:

Canola (*Brassica napus* L.) is considered a new untraditional oil crop in the Kingdom of Saudi Arabia. Canola oil is now the third largest source of edible oil following soybean and palm oil (Nowlin 1991). This increased demand will undoubtedly promote increased acreage of canola in the world where some soils are prone to become saline (Francois 1994). Saline soils and saline irrigation waters present potential hazards to canola production and expansion.

Germination is the most critical period for a crop subjected to salinity. Germination failures under saline soils are often the results of high salt concentrations in the seed planting zone because of upward movement of soil solution and subsequent evaporation at the soil surface (Bernstein 1974).These salts interfere with seed germination and crop establishment (Fowler 1991). Seed germination have been reported to decline with

تأثير الطحالب والنيتروجين على إنتاج ومكونات الإنتاج وامتصاص النيتروجين والفسفور في الأرز الحساوي

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الأحساء - المملكة العربية السعودية

الملخص:

أجريت تجربة أصص خلال موسم صيف 1999 – 2000م (شهر مارس – يونيو) ، حيث درس تأثير الطحالب الزرقاء المخضرة ومعدلات النيتروجين على إنتاج ، مكونات الإنتاج، وامتصاص النيتروجين والفسفور في محصول الأرز الحساوي (Oryza sativa). أعطى النيتروجين والفسفور زيادة معنوية مع إضافة الطحالب ومع كل زيادة بسيطة للنيتروجين على الإنتاج، مكونات الإنتاج والامتصاص الغذائي للمحصول، كان هناك زيادة في المحصول ومكوناته عند إضافة 20 جم/الأص من الطحالب. زادت معنوياً إنتاجية الحبوب من 10.5 طن/هكتار (بدون أسمدة) إلى 14.3 طن/هكتار (بإضافة 20 جم طحالب/أص). أدت إضافة 150 كجم نيتروجين/هكتار إلى زيادة معنوية في كمية الحبوب خلال الموسمين مقارنة بالمعاملتين صفر و50 كجم نيتروجين/هكتار، بينما لم تختلف المعاملة 150 كجم نيتروجين/هكتار معنوياً عن المعاملة 100 كجم نيتروجين/ هكتار خلال موسم 2000م في إنتاجية الحبوب.

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* Calculated From Raw Data.

Phosphorus uptake increased significantly with seston application and nitrogen application (Table 3). Like nitrogen uptake, phosphorus uptake increase was substantial. Menon *et al.* (1998) and Rama-Krishnayya *et al.* (1998) reported similar findings. Enhanced growth as well as grain yield and higher nutrient uptake with sestoning maybe attributed to its favorable effect on the edaphic environment.

These results have indicated that sestoning of rice holds a great promise to increase crop yields and to economize fertilizer nitrogen in Hassawi rice production.

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Increase number of filled grains/spike was recorded as the nitrogen levels increased in both seasons. In 1999, 150 and 100 kg N/ha were at par and significantly superior to the other two levels of nitrogen. Moreover, 50 kg N/ha gave more filled grains/spike than the control. Also in 2000, both 150 and 100 kg N/ha were at par and were superior to 50 and 0 kg N/ha treatments.

The 150-kg N/ha treatment produced the highest number of filled grains and was at par with 100 kg N/ha when the data were pooled, and they were significantly differed from 50 kg N/ha.

Nitrogen uptake

Nitrogen uptake increased significantly with seston application and with the increase in the rate of applied nitrogen (Table 3). The increase in nitrogen uptake with sestoning average 46.7% (with 100 g/pot) and 94.7% (with 200 g/pot) in 1999 and 22.1% and 42.6% in 2000. These results are in line with those reported by Zhou and Kleinhofs (1996), Mandal *et al*. (1999) and Thind and Rowell (1999). Similarly, as the rate of fertilizer nitrogen increased from 50 to 150 kg N/ha, average nitrogen uptake by Hassawi rice increased by 19.4% in 1999 and by 45.8 in 2000.

Table (3)
Nitrogen and phosphorus uptake (kg/ha) of summer rice as affected by nitrogen and seston application.

Treatment	Nitrogen			phosphorus		
	1999	2000	mean	1999	2000	Mean
Seston rate (g/pot)						
0	30.4	44.8	37.6	6.7	7.3	7.0
100	44.6	54.7	44.7	7.0	13.5	10.3
200	59.2	63.9	61.6	9.7	16.0	12.9
LSD (0.05)*	3.64	4.27	3.83	1.03	1.64	1.21
Nitrogen (kg/ha)						
0	49.5	65.1	57.3	7.5	10.8	9.2
50	60.9	69.8	65.4	9.7	13.4	11.6
100	67.8	75.6	71.7	10.7	15.5	13.1
150	72.7	101.8	87.3	11.9	18.4	15.2
LSD (0.05)*	2.95	3.04	2.69	0.76	0.82	0.73

condition during the spike initiation stage. Nitrogen at 100 and 150 kg/ha recorded similar number of grains/spike in 1999 and 2000. These two levels produced significantly higher number of grains/spike than 50 kg N/ha level. However in 2000. 100 and 50 kg N/ha levels were at par. Again in that year. 50 kg N/ha level could not improve the number or grains/spike over the 0 kg N/ha level, although in 1999, there were significant differences between these two levels of nitrogen.

Table (2)
Grain and filled grains/spike of summer rice as affected by nitrogen and seston application.

Treatment	Grain/spike			Filled grain/spike		
	1999	2000	mean	1999	2000	Mean
Seston rate (g/pot)						
0	80.4	84.3	82.4	69.8	70.6	70.2
100	81.3	85.2	83.3	72.1	73.4	72.4
200	91.1	92.8	92.0	76.8	78.3	77.6
LSD (0.05)*	3.08	1.67	2.44	1.53	3.66	2.49
Nitrogen (kg/ha)						
0	78.2	83.7	81.0	65.8	68.5	67.2
50	83.9	87.1	85.5	71.7	72.3	72.0
100	91.3	92.5	91.9	75.9	76.7	76.3
150	92.8	93.2	93.0	77.4	78.9	78.2
LSD (0.05)*	2.73	3.65	3.05	3.21	3.42	3.12

* Calculated From Raw Data.

The pooled data of two years reveal that the highest number of grains/spike was obtained with 150 kg N/ha which was not significantly different from the 100 kg N/ha but it was significantly superior to the 50 kg N/ha and the 0 kg N/ha treatment. This was obviously because of better crop nutrition in the presence of nitrogen.

Filled grains/spike

The maximum filled grains/spike was produced with the 200 g/pot treatment, followed by the 100 g/pot and no seston in both seasons. However, these under 100 g/pot and no seston were at par in 2000. Similar trend was also observed when the data were pooled (Table 2).

The maximum grain yield was obtained with 150 kg N/ha (Table 1), which was significantly superior than that of 100 kg N/ha. The lowest yield was found under the control. A similar trend was also observed when the data were pooled. However, 50 kg N/ha was found on a par with 100-kg N/ha. Both were being significantly superior to the control in both seasons.

Kumar and Verma (1981) found that upland, rice rsponded up to 150 kg N/ha, whereas Singh *et al.* (1983) observed gradual increase in the yield of upland rice up to 80 kg N/ha.

Straw yield

The straw yield was the highest under the 200-g seston/pot treatment in both seasons (Table 1). This was not significantly different from the 100-g seston/pot in 2000. The combined analysis shows that the straw yield was significantly higher under the 200 than the 100-g/pot treatments, which in turn was again significantly higher than the control. Higher straw yields with seston application, particularly when 200-g seston/pot was applied, might be because of better soil-moisture and fertility conditions that helped in better vegetative growth of the rice. This conforms the findings of Pravdivaya *et al.,* 1988 and Temple *et al.,* 1989.

The effect of nitrogen levels was not significant in 1999, whereas in 2000 all the levels produced significantly higher straw yields over the control. In 1999, the crop perhaps could not utilized most of the applied nitrogen for dry-matter production. But in the second year, under optimum soil-moisture conditions, increased nitrogen levels resulted in more utilization of nitrogen by the crop for dry-matter production. The pooled data revealed that all the 3 levels of nitrogen (50, 100 and 150 kg N/ha) gave significantly higher straw yields than the control. Although, they were at par among themselves.

Grains/spike

The 200-g seston/pot (Table 2) produced significantly higher number of grains/spike than the 100-g seston /pot and the control. The combined analysis of the two seasons indicated that the 200-g seston/pot and no seston, the latter two treatments being at par. The beneficial effect of the addition of the seston may again be attributed to better soil-moisture

Results and Discussion

Grain yield

The grain yield was significantly higher under 200-g seston/pot than the 100-g seston/pot and the control in both seasons (Table 1). During 1999, this treatment recorded lower grain yield than that during 2000.

Table (1)
Grain and straw yields of summer rice as affected by nitrogen and seston application.

Treatment	Grain yield (t/ha)			Straw yield (t/ha)		
	1999	2000	mean	1999	2000	Mean
Seston rate (g/pot)						
0	8.5	12.4	10.5	22.2	24.6	23.4
100	12.4	12.6	12.5	25.8	28.4	27.1
200	13.0	15.6	14.3	29.3	31.7	30.5
LSD (0.05)*	2.64	1.70	1.24	2.49	3.56	2.58
Nitrogen (kg/ha)						
0	10.3	11.2	10.2	23.7	25.7	24.4
50	11.2	13.2	12.2	26.6	28.4	27.5
100	12.4	13.9	13.1	26.7	28.7	27.7
150	13.2	14.9	14.1	28.0	28.9	28.4
LSD (0.05)*	0.71	0.82	0.68	n.s.	1.04	1.84

n.s. = Not significant
* Calculated From Raw Data.

However, the 100-g seston/pot application recorded more grain yields than the control during both seasons. During 1999, the application of 200-g seston/pot was not significantly different from that of the 100-g seston/pot, both being superior to the control. But during 2000, the 200-g seston/pot application was found superior to both 100-g seston/pot and the control and the latter two were not significantly different. The pooled data of the two seasons also revealed that grain yields were significantly higher under the 200-g seston/pot than under the 100-g seston/pot. The beneficial effect of seston may be attributed to better conservation of soil moisture, which might have helped in improving the growth and yield of crop. This substantiates the findings of Alla-El-Din and Shalan, 1989 and Santra, 1993.

the statistical significance of the effect of treatments according to the procedure outline by Steel and Torrie (1988).

study the effect of seston and levels of nitrogen on the yield and yield attributes of Hassawi rice.

Material and Methods

A pot experiment was conducted in a green house at the Agricultural and Veterinary Training and Research Station, King Faisal University in Al-Hassa, Saudi Arabia during the summer seasons (March to June) of 1999 and 2000. Hassawi rice was grown in plastic pots (100 cm in diameter) filled with soil composed of fine sand (61.8%,) coarse sand (9.6%), silt (25.2%), clay (4.5%) and organic carbon (0.49%) with a pH of 7.2. Twenty-five seeds of Hassawi rice were sown per pot, later thinned to 15 per pot.

12 treatment combinations involving 3 seston treatments (0, 100 and 200 g/pot) and 4 levels of nitrogen (0, 50, 100 and 150 kg N/ha) replicated 4 times in split plot design were used. Nitrogen rates as the main plots and seston levels as subplots.

A basal dose of phosphorus and potassium were applied at 75 kg P_2O_5 /ha and 50 kg K_2O/ha in the form of triple superphosphate (48% P_2O_5) and murate of potash respectively. Nitrogen was applied in the form of urea (46% N) as per treatment in two equal splits, one before sowing and the other at the tillering stage. Seeds of Hassawi rice were sown on 18 March 1999 and 3 March 2000. Seston collected from the shore of the Arabian Gulf was applied according to the treatments just after sowing over the soil surface. The crop was harvested on 25 June and 20 June in 1999 and 2000 respectively.

At harvest number of grains/spike, number of filled grains/ spike, grain and straw yields were determined on samples of 10 plants/pots immediately after harvest 3 plants/pot were randomly sampled, oven dried at 80°C for 24 hours and ground to pass a 20 mm-mesh screen to estimate nitrogen and phosphorus uptake. Total nitrogen was determined on composite plant samples by the Kjeldahl distillation method (Bremner, 1965). For phosphorus determination, the plant material was digested with nitric, sulphuric and perchloric acid mixture. Phosphorus concentration in the extract was determined by Vanadomolybodo-phosphoric yellow color method (Jackson, 1968). Analysis of variance was performed to determine

Seston and Nitrogen Effects on Yield and N, P Uptake of Rice (*Oryza sativa* L. cv. Hassawi)

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Abstract

In a pot experiment conducted during the summer seasons March-June of 1999 and 2000 the effects of seston (100 and 200 g/pot) and different nitrogen levels (0, 50, 100 and 150 kg N/ha) on yield. Yield components and nutrient uptake of Hassawi rice (*Oryza sativa*) were studied. Yield, yield components and uptake of N and P significantly increased with seston application and with each successive increment of nitrogen. Grain yield increased significantly from 10.5 t/ha without seston to 14.3 t/ha with 200 g/pot seston. Grain yield was the highest under 150 kg N/ha and was significantly superior to both 0 and 50 kg N/ha treatments in both the seasons, but was on a par with the 100 kg N/ha in the second season.

Introduction

Hassawi rice (*Oryza sativa* L.) is generally grown in Al-Hassa from February – March to June-July. During this period, the crop is irrigated by flood irrigation and even though the yield is quite low. Since irrigation water in Saudi Arabia is scarce (Al-Amoud and Mohammad, 1995), it may be beneficial to adopt certain soil-moisture conservation practices like the use of seston (Blue green Algae biomass accumulated in water reservoirs). The role of blue-green algae (BGA) is supplying N to rice field is well documented. In addition, they also bring about, directly or indirectly, a number of changes in the physical, chemical and biological properties of the soil and soil-water interface in rice fields (Mandal et al., 1999). BGA liberate extracellular organic compounds and photosynthetic O_2 during their growth and on decomposing of different organic acid in soil (Rogers and Ladha, 1992). All changes brought about by BGA in soil may ultimately influenced plant-available nutrients. Also optimum levels of fertilizer nutrient, particularly nitrogen plays an important role in boosting the yields (Mandal et al., 1999). In the present investigation an attempt was made to

تأثير حامول الحقل على بعض المحاصيل البقولية

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الأحساء – المملكة العربية السعودية

الملخص :

تم اختبار اثني عشر محصولاً بقولياً لدراسة تأثير طفيل حامول الحقل عليها . وقد أظهرت المحاصيل المدروسة تبايناً كبيراً في استجابتها لتطفل حامول الحقل . ووفقاً للفقد في الوزن الجاف للعائل (الفقد في وزن الناتج الحيوي) الذي سببه الطفيل ، فقد تم تقسم المحاصيل المدروسة إلى ثلاث مجموعات : المحاصيل التي فقدت أكثر من 50٪ من وزنها الحيوي اعتبرت ذات قابلية عالية للإصابة ، وتلك التي فقدت ما بين 10- 50٪ من وزنها الحيوي اعتبرت ذات قابلية للإصابة ، والتي فقدت أقل من 10٪ من وزنها الحيوي اعتبرت مقاومة . وقد أوضحت نتائج الدراسة اشتمال المجموعة الأولى (ذات القابلية العالية للإصابة) على 6 محاصيل (اللبلاب ، العدس ، الحمص ، الفول البلدي ، البرسيم الحجازي ، البازلاء العلفية) ، والمجموعة الثانية (ذات القابلية للإصابة) على 4 محاصيل (الحلبة ، البرسيم المصري ، الترمس ، البازلاء) والمجموعة الثالثة (المقاومة للإصابة) على محصولين (الفاصولياء والجلبان) من جملة المحاصيل المدروسة . وقد ظهر من جراء التطفل أن نبات اللبلاب كان أكثر النباتات تضرراً (75٪ فقد في الوزن الحيوي) بينما كان نبات الفاصولياء أقل تضرراً (8.1٪ فقد في الوزن الحيوي) مقارنة مع المحاصيل البقولية الأخرى . ومع ذلك ، ففي نبات الجلبان كان للطفيل أثر إيجابي على صفات النمو (17.6٪ زيادة في الوزن الحيوي) ، وارتبطت الفواقد ذات المعنوية في صفات نمو المحاصيل ذات القابلية للإصابة والمحاصيل ذات القابلية العالية للإصابة بزيادة ملحوظة في الناتج الخضري (الوزن الجاف) لحامول الحقل .

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Means with the same letter in each column are not significantly different according to Duncan's multiple range test.

(Farah, 2000). On the other hand, the parasite did not encounter any resistance on susceptible and highly susceptible crops with 0.34 g and 0.64 g mean dry matter of field dodder per host plant, respectively (Table 4). This is in agreement with with the work of Rao and Reddy (1987), who reported that on green gram china dodder dry matter per individual was 1.88g,while on cluster bean the dodder dry matter per individual was 0.47g. Based on their general performance as influenced by field dodder, the tested twelve legume crops could be ranked as follows:

Hyacinth bean >lentil> chickpea > broad bean > alfalfa > fodder pea > fenugreek > Egyptian clover > lupin > garden pea > kidney bean > vetch.

The parasitic damage appeared to be of a greater magnitude on hyacinth bean and of a lesser magnitude on kidney bean and vetch.

The results of the experiment thus revealed that the cultivation of hyacinth bean, lentil, chickpea, alfalfa, broad bean and fodder pea (highly susceptible crops), and fenugreek, Egyptian clover, garden pea and lupin (susceptible crops) in soils known to be infested with field dodder, should be avoided. The resistant crops (kidney bean and vetch) should be used as trap crops or incorporated in a suitable crop rotation system in order to combat the menace of this serious parasite.

Table (3)

Classification of the tested legume crops (Based on % loss of their biological yield due to effect of field dodder).

Host crop	% loss of host biological yield*	Host response to the parasitism of field dodder
Hyacinth bean	-75.0	Highly susceptible
Lentil	-66.3	Highly susceptible
Chickpea	-65.0	Highly susceptible
Broad bean	-59.3	Highly susceptible
Alfalfa	-56.5	Highly susceptible
Fodder pea	-54.5	Highly susceptible
Fenugreek	-45.3	Susceptible
Egyptian clover	-44.2	Susceptible
Lupin	-42.3	Susceptible
Garden pea	-38.2	Susceptible
Kidney bean	-8.1	Resistant
Vetch	+17.6	Resistant

*The legume crops are arranged in descending order of percentage loss.

Table (4)

Field dodder yield components (number of coils and dry weight of shoot system (g) per host) Field dodder

Host crop	Number of coils Per host	Dry weight of shoot (g) per host
Chickpea	9.00c	0.25 cd
Hyacinth bean 34.33bc	0.62b	0.13de
Vetch	10.66e	
Lentil	15.33de	0.44bc
Lupin	31.66c	0.32cd
Alfalfa	34.66bc	1.80a
Kidney bean	4.00e	0.04e
Fodder pea	28.00cd	0.34c
Garden pea	28.00cd	0.32cd
Egyptian clover	34.66bc	0.38c
Fenugreek	46.33b	0.34c
Broad bean	71.33a	0.36c

number of leaves per plant were observed in chickpea which amounted to 6.1% and 3.7%, respectively as comapred to the control. Similarly, the lowest percent reduction in dry weight of shoots (19.3%) and dry weight of roots (49.2%) were observed in garden pea and Egyptian clover, respectively. Hyacinth bean consistantly showed the maximum percent reductions in vegetative growth.

Four out of the studied twelve crops; namely, lentil, lupin, alfalfa and Egyptian clover did not reach the flowering stage until the trial termination. Although the rest reached the reproductive stage, they showed great variations in their capacity to produce flowers and pods. The lowest percent reductions in the number of flowers per plant (6.3%) and the number of pods per plant (11.7%) were observed in garden pea, while both characters were completely affected (100% reduction) in chickpea, hyacinth bean and broad bean. Among the various parameters implemented in this study, the reduction in the host biological yield (BY) was used as a criterion to evaluate and to classify the response of the tested crops to field dodder parasitism. Biological yield of the legume crops varied significantly due to treatments (Table 3). Dodder had a detrimental effect on yield attributes leading to low biological yield of hyacinth bean, lentil, chickpea, alfalfa, broad bean and fodder pea and hence considered to be highly susceptible. Fenugreek, Egyptian clover, garden pea and lupin were considered susceptible. Kidney bean and vetch recorded more BY compared with the other crops and so they were resistant (Table 3).Bebawi and Michael (1991), Zaitoun *et al*. (1991) and Al-Menoufi and Farag (1996) reportred that legume crops varied significantly in their response to the infection of parasitic weeds. On the three groups field dodder exhibited great variations (Table 4). It seems that the dry matter of field dodder per host is another reliable criterion to assess the response of the tested crops to field dodder's parasitism, compared to the number of coils of field dodder per host. This is because the dry matter of field dodder is a function of the host resistant level, while the number of coils of field dodder depends mainly on the length of the parasitized organ, e.g. the length of the internode or of the petiole. The resistant crops with 0.08 g mean dry matter of field dodder per host plant, manifested a depressing effect on the parasite growth and consequently the latter dried up and sucucumed due to lack of nourishment

Table (2)

A summary of the Performance of vegetative and reproductive characters of the tested legume crops under the influence of field dodder showing the percentage loss below the control treatment, averaged over two seasons(1997 and 1998)

Host crop	Plant height (CM)	Number of leaves/plant	Dry weight of shoot system (GM)	Dry weight of root system (GM)	Number of flowers/plant	Number of pods/plant
Chickpea	-14.3i	-11.1i	-44.3c	-62.1c	-90.0a	-90.0a
Hyacinth bean	-49.7b	-45.0a	-53.0a	-68.2a	-90.0a	-90.0a
Vetch	+59.4a	+41.8b	+24.7i	+24.9g	+51.1b	+60.1b
Lentil	-28.5f	-26.1e	-47.8b	-61.9c	0.0f*	0.0g
Lupin	-14.9i	-14.8h	-36.0f	-45.0f	0.0f	0.0g
Alfalfa	-33.0d	-28.0d	-33.8g	-64.9b	0.0f	0.0g
Kidney bean	-14.2i	-10.9i	-14.4j	-18.7h	-13.8e	-16.0f
Fodder pea	-31.0ed	-16.5g	42.0d	-53.3d	-17.1d	-27.6d
Garden pea	-23.3h	-11.8i	-26.1i	-49.1e	-14.5e	-20.0e
Egyptian clover	-43.7c	-27.6ed	-38.8e	-44.5f	0.0f	0.0g
Fenugreek	-30.7e	-35.7c	-30.2h	-53.9d	-35.1c	-36.3c
Broad bean	-26.2g	-23.3f	-41.0d	-60.7c	-90.0a	-90.0a

Statistical analysis applied to the ArcSine (square root transformation) of percentage loss.
Means followed by the same letter in each column are not significantly different at P = 0.05, according to Duncan's multiple range test.
* The perscibed phase was not achieved.

1996), but for vetch this is the first record of its resistance to *C. campestris.* The other ten crops showed variable reductions due to field dodder infestation (Table 2). The lowest percent reductions in both plant height and

28ºC/23ºC). Irrigation was practiced using tap water (EC = 2 ds/m, pH= 7.1) every two days. Weeds other than field dodder were controlled by hand every two weeks until the termination of the experiment. Eight weeks after sowing, data were collected on plant height (cm), number of leaves per plant, while dry weight of shoots (g), dry weight of roots (g), the biological yield (BY) [(dry weight of shoots + dry weight of roots (g)], the number of flowers per plant, and the number of pods per plant; and for the parasite, number of coils per host and dry weight of shoots per host (g) were recorded at harvest. Analysis of variance was conducted using the General Linear Models Procedure of the Statistical Analysis and treatment means were averaged over the two seasons and compared according to Duncan's multiple range test at 5% level of significance (SAS, 1990). Losses from *C. campestris* in the tested crops could be assessed by comparing dodder infested plants with dodder free ones. The relative loss (X%) of the growth trait was calculated according to Kroschel *et al.* (1996) as follows:

$$X\% = \frac{C-T}{C} \times 100$$

Where C is the value of the growth trait in dodder free plants, T is the value of the growth trait in dodder infested plants; while the reduction in the biological yield (BY) was estimated as the average of the reductions in the dry weights of shoots and roots.

Results and Discussion

Field dodder (*Cuscuta campestris* Yuncker) caused variable reductions in the vegetative (plant height, number of leaves per plant, dry weights of shoot and root systems) and reproductive (number of flowers per plant and number of pods per plant) traits of the tested crops (Table 2). Crops tested showed differential behaviour in relation to dodder parasitism. Kidney bean recorded the lowest reductions in all traits, as it had a hypersensitive reaction against field dodder parasitism (Farah, 2000). On the other hand, vetch characters were found to increase in the presence of field dodder instead of being decreased. This may be attributed to the promotive effects of field dodder on vetch growth resulting in more internodes and lateral branches. Similar results were reported by Abdalla and Siddig (1993) in roselle parasitized by *C. hyalina*. The resistance of kidney bean to field dodder has been well documented in literature (Nemli, 1987; Arnaud *et al.*,

ICARDA (Internaitonal Centre for Agricultural Research in the Dry Areas, Aleppo, Syria), Egypt, Sudan and Saudi Arabia (Table 1).

Table (1)
List of Legume crops tested and their sources

Common Name	Crop species (Scientific Name)	Source
Chickpea	*Cicer arietinum* L.	ICARDA
Hyacinth bean	*Dolichos lablab* L.	Sudan
Vetch	*Lathyrus sativus* L.	ICARDA
Lentil	*Lens culinaris* Miller	ICARDA
Lupin	*Lupinus termis* L.	Al-Hassa, Saudi Arabia
Alfalfa	*Medicago sativa* L.	Al-Hassa, Saudi Arabia
French bean	*Phaseolus vulgaris* L.	Sudan
Fodder pea	*Pisum arvense* L.	Egypt
Garden pea	*Pisum sativum* L.	ICARDA
Egyptian clover	*Trifolium alexandrinum* L.	Egypt
Fenugreek	*Trigonella foenumgraecum* L.	ICARDA
Broad bean	*Vicia faba* L.	Sudan

The Greenhouse Experiment:

The greenhouse experiment was conducted at the Agricultural and Veterinary Training and Research Centre, King Faisal University, Al-Hassa (25^{o} 22' N latitude; 49^{o}34' E longitude),Saudi Arabia. The legume crops were raised in 25 cm plastic pots containing a 1:1 mixture of sand and peatmoss. For 50% of the pots the top half of the soil was thoroughly mixed with 0.5 g of field dodder seeds. The other 50% were left without field dodder seeds (untreated control). Treatments were arranged in a completely randomized design with four replications for each crop. Ten seeds per pot were sown on 17th November 1997 and 1998. At planting, all pots received a nitrogenous fertilizer in the form of urea (46% N) at the rate of 70 Kg N/ha. Two weeks after emergence, the seedlings were thinned to three per pot. The pots were placed in a greenhouse (day and night temperatures were

(Beliz, 1987). Many species of *Cuscuta* have been introduced to different parts of the world due to similarity of their seeds to those of commercial crops, especially legumes like alfalfa (*Medicago sativa* L.) and clover (*Trifolium* spp.).

Both legume crops and dodders are economically important. Legume crops constitute a major group of crops in the world. They provide human food, animal feed and material for industrial uses. Their nutritional value as a source of protein has long been recognized. However, only recently legume crops have risen to prominance in the Kingdom of Saudi Arabia (Al-Tahir *et al*. 1989). On the other hand, dodders are regarded as the most important parasitic weeds that represent a serious threat to a wide range of crops, particularly legumes, in Saudi Arabia (Farah, 1991). Four speices of *Cuscuta* were reported in Saudi Arabia. namely, *C*. c*ampestris* Yuncker, *C. hyalina* Roth.,*C. pedicellata* Ladeb and *C. planiflora* Tenore (Al-Farhan, 1994). The economic importance of *C. campestris* stems from the fact that it parasitizes several important crop plants and reduces their yield substantially. In addition, this parasite has become one of the major constraints that limit productivity of crops in different parts of the world. The objectives of this work were to study the effect of field dodder (*C. campestris*) on growth and development of twelve legume crops namely, chickpea (*Cicer arietinum* L.), hyacinth bean (*Dolichos lablab* L.), vetch (*Lathyrus sativus* L.), lentil (*Lens culinaris* Miller), Lupin (*Lupinus termis* L.), alfalfa (*Medicago sativa* L.), kidney bean (*Phaseolus vulgaris* L.), fodder pea (*Pisum arvense* L.), garden pea (*Pisum sativum* L.), Egyptain clover (*Trifolium alexandrinum* L.), fenugreek (*Trigonella foenum-gracecum* L.) and broad bean (*Vicia faba* L.) and to estimate the losses occurred due to field dodder parasitism.

Materials and Methods

The experimental seeds: seeds of field dodder were collected from alfalfa fields in Al-Hassa, Eastern Province, Saudi Arabia. The seeds were surface sterilized with 1% sodium hypochlorite solution, rinsed in distilled water, dried and stored in dark at room temperature (26ºC). Seeds of legume crops for the experimental work were obtained from different sources including

Effect of Field Dodder (*Cuscuta campestris* Yuncker) on Some Legume Crops

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Abstract:

Twelve legume crops were tested to study the effect of field dodder (*Cuscuta campestris* Yuncker) on them. The tested crops showed great variations in response to field dodder parasitism. Based on the reduction in host dry weight (biological yield) caused by the parasite, the tested crops were classified into three groups: crops that lost > 50% of the their biological yield were considered highly susceptible, those that lost 10-50% of their biological yield were considered susceptible and those that lost < 10% of their biological yield were considered resistant. The results of the study revealed that among the tested legume crops the first group (the highly susceptible) comprised 6 crops (hyacinth bean, lens, chickpea, broad bean, alfalfa, fodder pea), the second group (the susceptible) comprised 4 crops (fenugreek, Egyptian clover, lupin, garden pea) and the third group (the resistant) comprised 2 crops (kidney bean and vetch). The parasitic damage appeared to be of greater magnitude on hyacinth bean (75% loss of biological yield) and of lesser magnitude on kidney bean (8.1% loss of biological yield) as compared to the other legumes. However, in vetch the parasite had a positive effect on its growth traits (17% increase in biological yield). The significant reductions in the growth parameters of susceptible and highly susceptible crops were associated with a marked increase in shoot yield of field dodder.

Introduction

Cuscuta, which belongs to the family Cuscutaceae, is a genus of cosmopolitan occurrence, thus *Cuscuta* species are widely distributed and colonized a diversity of habitats throughout the temperate and tropical zones

إصابة أغنام شامية بإلتهاب الأورف الحاد بالمملكة العربية السعودية

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الأحساء – المملكة العربية السعودية

الملخص:

أصيب قطيع من الأغنام الشامية بمرض الأورف الحاد جداً، حيث ظهرت على الأغنام أعراض سريريه بصوره بثور حول اللثة والشفاة ، كما بدى عليها تورم شديد للفم والتهاب وأحمرار الأغشية المحيطة بتجويف الفم0

بلغت النسبة المؤية للأتصالات بين القطيع نحو 86٪ ولم تؤدي تلك الإصابات الى حدوث أي نفوق بين الحيوانات المصابة0

تم عزل الفيروس المسبب للمرض والتعرف عليه وأحداث المرض تجريبياً على عدد أثنين من الأغنام العرضية، كما ناقشت الدراسة الطرق السليمة للسيطرة على المرض في المملكة0

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Absence of swelling of the buccal cavity and inflammation of the mucosa of the tongue, hard palets, checks and gums of the experimentally infected goats, proved another evidence supporting the above stated view, that the severity of the lesions encountered on the shami goats were probably been influenced by the ingestion and mastication of the pasture weeds. However, variation between shami and dwarf Ardy goats breeds, in response to the disease, could not be excluded.

Yearly complaints of the local veterinarians from orf, in and around Al-Hassa region (personal communication) are noted. Since no vaccination is practiced, so far, in Saudi Arabia, farmers are advised to graze their animals on non-weeds pasture. The implementation of vaccination regimen using local orf virus strain is believed to be the best control measure for the disease in the country, along with adoption of the standard hygienic measures.

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weight or deaths in affected lambs and kids (Mazur and Machado, 1989; Zamri-Saad *et al*. 1993). The unusual swollen buccal cavity, inflammation of its entire mucosa and the offensive mouth breath of the shami affected goats in the present study, were evidence for involvement of other complicating factors. Such secondary complications were attributed to bacterial infection (Robinson and Balassu, 1981; Zamri-Saad *et al*. 1993) or due to myiasis (Housawi and Abu Elzein, 2000).

In addition, to physical contact with infective material or affected animal, injury of the tissues of the mouth mucosa or the skin is an essential factor for establishing natural and experimental orf infection (Mckeever *et al,* 1988). In the present study, the development of papules, pustules and ulcerative nodules on the entire mucosa of the buccal cavity indicated that, there were abrasions being established in the mouth tissue, most likely, to be induced during grazing and mastication.

It is well documented that various parts of the world, the type of plants grazed by sheeps and goats may predispose them to orf virus infection. For instance, Hawkins *et al.* (1991) described an unusual outbreak of contagious ecthyma in sheep associated with grazing of the caltrop weed (Tribulus spp.). In the locality where the shami goats, in this study, were kept (Eastern Saudi) three types of weeds are known to grow in the pastures. According to Dr. Y. Hussein (Personal communication) these are *Tribulus terrestries* (caltrop), *Centaurea solstitialis* (Yellow star thistle) and *Xanthum* spp. (*X. italicum* and *X. strumarium*). Since these weeds were proved to have some toxic effects on sheep and goats (Clark *et al.* 1981), this could have some attribution to the aggravated orf conditions in the shami goats in the present study. However, this needs further studies. Another explanation for the extreme severity of the disease on the affected animals in the present study is that, the sero naïve-shami goats could have been exposed to a very virulent orf virus.

Typical orf lesions were established in the experimental two Ardy-goats (Mckeever, *et al*. 1988; Abu Elzein and Housawi, 1997). However, the developed lesions were confined to the skin of the site of infection, around the mouth and lip commissures.

Fig. (3) : Complete recovery and sloughing off scabs from experimentally infected ardy-goat.

Virus Isolation

Monolayers of the inoculated primary lamb testicle cells (PLT) showed cell rounding at day 3 post-inoculation, however, complete destruction and removal of the cell sheet was seen on day 5 post-inoculation. Further, two passages were carried out on PLT cells and another two passages were made on Vero cells. Control cells monolayers remained unaffected.

Virus Identification

Strong line of precipitation was seen between the 50% suspension of scab material and the reference anti orf hyperimmune serum. The non-immune serum rabbit did not give a precipitation line.

The infectivity of the isolated virus was completely blocked by the serum anti orf hyperimmune serum in the SNT neutralization test, whereas, the non-immune rabbit serum failed to do so.

Discussion

Orf disease in adult animals is usually benign with recovery between 2-3 weeks (Robinson and Balassu, 1981; Nettleton *et al*. 1996). But the severe or complicated form of the disease is often accompanied by losses in body

Results

Clinical Observation on the Natural Disease:

Despite the severe lesions which included massive swelling of the buccal cavity, blisters formation and the inflammation of the entire mucosa of the hard palates, checks, tongue, gums and presence of lesions or the lip commissiures, no deaths were encountered on the diseased animals. After the fifth day of administration of the treatment, the affected animals began to chew green soft food (Alfalfa) carefully. The body temperature restored to its normal level and the swelling of the buccal cavity was reduced nearly to its ordinary size and shape, but complete recovery and sloughing of the scabs took 37 days.

Result of the Experimental Study:

Typical orf lesions were produced on the two Ardy goats (Fig. 2). The lesions progressed from erythema to papules, pustules and to irregular crusty scabs. All of the lesions were confined to the skin of the mouth and lips. No rise in body temperature was detected. Scabs were later collected and used for viral reisolation and identification. The affected animals completely recovered from the disease 4 to 5 weeks post-infection (Fig.3).

Fig. (2) : Scabs lesions around the mouth of experimentally infected ardy-goat.

Animals

The age of the affected goats was between 2-5 years old, they were of Syrian origin being introduced and bred in Saudi Arabia twenty years ago. They were managed and fed indoors most of the time. However, they are allowed to graze outdoor for three to four hours daily during winter, when grass and weeds are usually available.

Treatment

Soon after examination, orf was suspected. All the affected goats were isolated and given supportive treatment. They were injected intramuscularly with multivitamins (Oligovet Belgium) 1 ml/10 kg body weight and Oxytetracycline (3-5 mg/kg body weight). Each animal was also treated with combined anti-edematous and anti-inflammatory drug, Diurizone (Vetoquinol, France) 2 ml for three consecutive days and locally with Alamycin (NorBook, N. Ireland).

Virus Isolation

Scabs material from affected goats were collected in sterile containers and sent to the laboratory and stored at –86ºC. The inoculum was prepared by grinding the scabs to produce 10% suspension in F-12 medium (Sigma), free of serum, pH 7.4. The 10% suspension was spun down by low speed centrifugation (2000 g) for 15 minute and 1000 units of penicillin and 1000 µg of streptomycin were added. The inoculum was then used to infect primary lamb testicle cell culture and later it was passaged onto Vero cell line (Abu Elzain and Housawi, 1997).

Identification of the Isolated Viruses:

The agar gel precipitation test (AGPT) was carried out using 50% suspension of scab material against known anti orf hyperimmune serum as described elsewhere (Housawi et al. 1992).

Micro-serum neutralization test (SNT) was conducted using the isolate and the reference anti orf hyperimmune serum (Abu El-zein and Housawi, 1997).

Experimental Infection of Goats:

Two Ardy goats (aged 6 months) were used for experimental reproduction of the disease. The goats had no previous history of contracting orf disease; they were tested and found to have no anti orf antibodies by SNT as described by Housawi and Abu Elzein, (2000).

ulcerative nodules on the mucosa of the lower lip, gum and tongue of the naturally-infected shami goat.

1989) to very mild and transient form (Zamri-Saad et al, 1993). The present study reports on a severe form of orf infection in adult shami goats.

Material and Methods

Clinical investigation

In March 1999 a flock of fancy shami goats was struck with severe skin disease in Aloyoune district, north of Al-Hassa in the eastern region of Saudi Arabia. The farm consisted of 110 adult goats, never had not experienced orf infection or contacted orf-infected animals before. In close examination, the sick goats showed lesions limited to the skin around the mouth and buccal cavity. The lesions involved were blisters and variable stages of papules, pustules and ulcerative nodules on the mucosa of hard palte, cheeks, tongue and gums. Scabs were also seen on the lips and lip comissuers. Remarkable inflammation of the entire mucosa of the mouth was noticed and massive swelling of the oral cavity (Fig.1). The mouth breach of the animals was extremely offensive. The body temperature ranged between 40.5-41^{o}C.

Due to the pain and the swelling in the buccal region, the goats had difficulty opening their mouth.

Fig. (1) : Scab Lesions on the margins of the upper and lower lips together with

Severe Inflammatory orf Infection in Fancy Shami Goats in Saudi Arabia

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Abstract:

A flock of fancy shami goats was hit with a very severe orf infection The affected animals showed massive swollen and inflammation of the mouth cavity. The morbidity rate was 86% with no fatality cases among the affected animals. The causative agent was isolated and identified and successful reproduction of the disease on two Ardy goats was obtained. Preventive measures for control of the disease are discussed.

Keywords: Severe orf, shami goats, Saudi Arabia.

Introduction:

Orf or contagious ecthyma is a pox disease of sheep and goats caused by a parapox virus, family poxviridae (Mckeever et al, 1988; Joshi et al, 1996). The disease is world wide distributed and occurs nearly in all countries where sheep and goats are raised (Robinson and Balassu, 1981). Affected animals develop lesions mainly on the skin of the lips progressing from erthyma to papules, pustules and eventually to irregular crusty scabs (Housawi et al, 1993, Zamri-Saad et al, 1993). However, occurrence of the lesions on other parts of the skin was seen on ears (Allworth et al. 1987; Housawi et al. 1991), polls of rams (Reid, 1991), Cornory band, legs, udder and tail (Schmidt and Hardy, 1932, Robinson and Balassu 1981).

Initial site of infection at the skin of the lips is usually induced by sharp objects during feeding (Hawkins, et al. 1991) but udder lesions usually occur as a result of ewes nursing infected lambs (Lewis, 1996).

Various forms of the disease were described from very virulent associated with high mortality (Darbyshire 1961, Mazur and Machado,

تأثير تبيط الغدة الدرقية المستحث على إخصاب الماعز خلال فصل الصيف

خالد بن أحمد البوسعده

قسم وظائف الأعضاء والكيمياء الحيوية والأقربازين – كلية الطب البيطري والثروة الحيوانية

جامعة الملك فيصل – الأحساء - المملكة العربية السعودية

الملخص :

لقد تم دراسة تأثيرات الكاربازرل المخصص لنشاط الغدة الدرقية في الأغنام خلال فصل الصيف. ولقد تبين أن الجرعة اليومية بمقدار 3 ملجرام للكيلوجرام من الكاربمازول ولمدة 11 يوما ثبطت عملية التبويض وتكوين الجسم الأصفر. وتشير النتائج إلى درجة الحرارة العالية والتي عادة ما تقلل من هرمونات الغدة الدرقية ربما أثرت على خصوبة الحيوانات عبر هرومونات الغدة الدرقية كما هو الحال في المعالجة بالكاربمازول.

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explained by the possibilities that impaired thyroid function may affect steroid feedback responses required for generation of pre-ovulatory luteinizing hormone surge and suppression of ovulation (Webster *et al*., 1991; Anderson and Barrell, 1998). The possibility for secretions of thyroid gland other than its hormones required for normal ovarian function cannot be ruled out.

Thyroid function in animals should decline as an acclimation response to increased heat after a few days to help alleviate heat stress (Pratt and Wettemann , 1986). This decline in thyroid function during heat stress may be due to effect of heat on hypothalamic-pituitary axis to cause reduction in thyrotrpoin releasing hormone which enables the animal to reduce basal metabolism (Johnson, 1987). Such decline in thyroid function may sometimes reduce fertility in animals as in case of CZ- induced hypothyroidism.

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Table (1)
Mean (± SD) plasma concentrations ofprogesterone and 13,14-dihydro-15-ketoprostaglandin F2a (PGFM) during two oestrous cycles in goats treated with saline (Group A) or carbimazole (Group B).

Days of Oestrous cycle	Progesterone (ng/ml)		PGFM (pg/ml)	
	Group A	Group A	Group B	Group B
0	< 0.1	< 0.1	800 ± 25	850 ± 25
5	2.9 ± 0.1	2.6 ± 0.1	50 ± 10	7 ± 10
10	4.3 ± 0.2	4.1 ± 0.2	80 ± 10	100 ± 10
15	2.1 ± 0.1	2.5 ± 0.1	680 ± 20	720 ± 20
0	< 0.1	< 0.1	950 ± 25	1050 ± 25
50	2.8 ± 0.1	< 0.1*	70 ± 10	110 ± 10
10	4.4 ± 0.2	< 0.1*	105 ± 10	75 ± 10
15	2.5 ± 0.1	< 0.1*	660 ± 20	70 ± 10*

* P<0.001

Discussions:

Induction of altered thyroid function by CZ in goats and laboratory animals have been reported earlier (Baquer *et. al.,* 1976); Ibrahim *et. al.,* 1984). The relative longer life span of goats when compared to laboratory animals, makes them of practical consideration to be used as a model to study chronic complications during altered thyroid function. The main objective of this study was to examine the role of hypothyroidism on fertility of goats during summer season when ambient temperature in this part of the world reaches a quiet high values. The results have indicated that CZ-induced hypothyroidism produced no effect on reproductive hom1ones initially, when administered during oestrous cycle. But in the subsequent oestrous cycle, ovulation did not occur as indicated by failure of corpus luteum fom1ation and absence of progesterone rise thereafter. Similar results due to thyroidectomy or suppression of thyroid function in female goats have been shown to impair or even abolish nom1al ovarian function (Reddy *et al.,* 1990; Walkden-Brown *et al.,* 1990). Such results may be

Animals in Group A (N = 8, Controls) received drench of saline from the Day of oestrous to Day 10 of the oestrous cycle (oestrous = Day 0).

Animals in Group B (N = 8) were treated exactly as Group A but with carbimazole (CZ) tablets (Neomercazole, Nicholas laboratories Ltd. UK). The tablets were powdered and dissolved in distilled water and given by drench at the rate of 3 mg/kg body weight.

In Groups A and B jugular blood (5ml) was collected daily by venipuncture using 23- gauge needle between Days 0 -20 of the oestrous cycle and the subsequent oestrous cycle. All blood sample were collected into heparinized nylon syringes and centrifuged at 1500 9 for 10 minutes. Plasma samples were stored at -20 °C until analyzed for hormones. All female goats were checked for oestrous twice daily by using a fertile buck and considered to be in oesrous when they stood for mounting.

Hormone Analysis: Progesterone and 13.14 dihydro-15 ketoprostaglandin, F2a (FGFM), the metabolite of prostaglandin F2a were measured by specific radioimmunoassay previously validated (Homeida and Cooke, 1982: Homeida, 1986). The intra- and inter-assay coefficients of variations were 4.4% (n = 15) and 12% (n = 20) respectively, for progesterone and 5.6% (n =10) and 11 % (n =15) respectively, for PGFM. The sensitivity of the assay was 48 pg/tube for progesterone and 10 pg/tube for PGFM. Extraction efficiency was 85.4 ± 4.8 % for progesterone and 87.1 ± 5.1% for PGFM and the results were corrected for extraction losses.

Statistical analysis: the results were compared by Student's t- test.

Results:

Similar pattern of hormone concentration during the first oestrous cycle in both Group A and B (Table 1) was observed. CZ produced no effect on luteal regression or oestrous. In the subsequent oestrous cycle, complete failure of luteal phase occurred in Group B. Progesterone values remained less than 0.1 ng/ml, which were significantly ($P < 0.001$) lower than values in Group A during days 5,10, and 15 of oestrous cycle. PGFM values were similar in the two groups, but significantly different ($P < 0.001$) on Day 15 of second oestrous cycle.

The Effect of Induced Hypothyroidism on Fertility of Goats During Summer Season

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Abstract :

The effects of Carbimazole (CZ)-induced hypothyroidism were investigated in goats during summer season. CZ treatment at a daily dose of 3mg/kg body weight for 11 days inhibited ovulation and corpus luteum formation. This suggested that heat stress, which usually causes a decline in thyroid hormones, may produce its effect on fertility in a similar manner to CZ-induced hypothyroidism.

Introduction:

Summer heat stress reduces fertility during summer in animals (Monty and Wolf 1974). Numerous reports have indicated that hot summer season causes a lowering of thyroid activity, resulting in low plasma concentration of thyroid hormones in most studied animals (Johnson and Vanjmack 1976; Hart *et. al,* 1979; Bell *et. al* 1985; Nixon *et. al* 1988; El Nouty *et. al* 1990). Thyroid hormones modulate metabolic processes (Ganong 2001; Browning *et. al* 1998). These metabolic hormones are involved in thermoregulation, because metabolism is a primary intrinsic source of heat (Finch 1986). This study was conducted to investigate the effect of induced hypothyroidism on fertility of goats during summer season.

Materials and Methods:

Animals: sixteen mature (2 -3 years) females Arady goats (weighing 25-30 kg) were used. They were housed in individual pens during summer season (June - August). After completion of one normal oestrous cycle (19 -20 days), the goats were randomly divided into two groups A&B. The treatment administered to each group A&B was as follows:

إن رفع نسبة اللايسين في العليقة الى 1.2 ٪ قد صاحبه زيادة في معدل الإنتاج (67.86 ٪) وفي معدل التحويل الغذائي (2.94 كجم/كجم) ولم يكن لهذه الزيادة أي تأثير معنوي على مكونات البيضة فيما عدا وزن الصفار في مجموعة 2.5 ٪ أرجنين.

وقد خلصت هذه الدراسة الى ان إحتياج الدجاج البلدي من الحامض الأميني الأرجنين واللايسين يمكن أن تكون في حدود 1.5 ٪ و 1.2 ٪ على التوالي.

تقدير إحتياجات الدجاج البلدي الغذائية:
1. تأثير إضافة كميات (تزيد عن إحتياجات دجاج الليجهورن) من الأرجنين على أداء الدجاج البلدي السعودي

هذيل نجيب و غازي بسيوني

قسم علوم الإنتاج الحيواني - كلية العلوم الزراعية والأغذية

جامعة الملك فيصل - الأحساء

المملكة العربية السعودية

الملخص:

عرف الأرجنين المحفز للتبويض في حيوانات المزرعة بدوره في تحفيز إفراز هرمون الإباضة في الماعز والأغنام. لذا فإن تغذية الطيور القليلة الإنتاج بعليقة تحتوي على كمية من الأرجنين اكبر مما هو مستخدم في عليقة دجاج الليجهورن قد يحفز إنتاج البيض في هذه الطيور.

هدفت هذه الدراسة الى محاولة تحسين انتاج البيض في الدجاج البلدي وذلك بتغذيتها على عليقة تحتوي على الأرجنين بمعدلات اكبر من تلك المستخدمة في عليقة الليجهورن كما هدفت الى دراسة تأثير هذه المعدلات مع زيادة نسبة اللايسين على اداء الدجاج البلدي.

وقد تم تنفيذ دراستين ، الأولى شملت 4 مستويات من الأرجنين و عليقة مقارنة (دون إضافة أرجنين) وفي الدراسة الثانية تم استخدام نفس المعاملات مع رفع نسبة اللايسين بمقدار 0.5 ٪ في عليقة الأساس ليصبح 1.2 ٪.

وقد أظهرت النتائج أن رفع نسبة الأرجنين الى 1.5 ٪ في عليقة الدجاج البلدي حسّن من معدل الإنتاج (59.22 ٪) ومعدل التحويل الغذائي (4.86 كجم/كجم) لكنّ تأثيرا عكسيا وبشكل خط مستقيم على إستهلاك العلف والوزن النوعي للبيضة ظهر عند زيادة كمية الأرجنين تدريجيا من 1 – 2.5 ٪ ومن 0 – 2.0 ٪ على التوالي.

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Table (4)

Effect of incorporating Arginine levels on Baladi layers, fed extra amount of Lysine (0.5 %) on performance and egg production[1]

SOURCE OF VARIATION	HD	EW	EM	FC	FI	SHWT	ALWT	YOWT	YOIN
TRT LEVELS, %[2]	NS	NS	NS	NS	NS	NS	NS	**	NS
0	48.21[a]	44.83[a]	21.38[a]	4.762[a]	89.7[a]	6.04[a]	23.22[a]	14.46[a]	76.30[ab]
1	55.36[a]	45.17[a]	24.94[a]	3.862[a]	94.1[a]	5.95[a]	23.49[a]	15.05[bc]	79.98[ab]
1.5	67.86[a]	43.58[a]	29.61[a]	2.943[a]	86.2[a]	5.91[a]	22.16[a]	14.95[bc]	74.46[b]
2	64.29[a]	44.16[a]	28.51[a]	3.630[a]	101.6[a]	6.28[a]	23.08[a]	15.56[ab]	81.70[a]
2.5	44.64[a]	44.86[a]	20.24[a]	8.360[a]	85.9[a]	6.31[a]	23.40[a]	15.88[c]	76.55[ab]
P	0.2679	0.6428	0.3403	0.4459	0.6046	0.1214	0.1557	0.0001	0.1319
± SEM	3.888	0.346	1.720	0.964	3.392	0.306	0.193	0.103	1.036
LINEAR	0.8412	0.5516	0.8434	0.3725	0.5401	0.3044	0.4921	0.0002	0.5056
QUADRATIC	0.0507	0.4549	0.0621	0.1523	0.2882	0.6072	0.3832	0.5876	0.1637

[1]Means within columns having different superscripts, are significantly different, P<0.05
[2]Percent level of arginine in the diets
TRT, treatment; HD, % hen-day production; EW, gram egg weight ; EM, Egg mass, gm; FC, kg/feed/kg eggs, feed conversion; FI, gram/bird/day feed intake; SHWT, Shell weight; ALWT, Albumen weight; YOWT, Yolk weight; YOIN, Yolk index. Yolk index = yolk height / yolk diameter X 100

Conclusion:

There was a clear evidence that incorporating Arginine in excess of the leghorn requirement to the Baladi birds enhance egg production parameters. However, when lysine was added in amount higher than the leghorn needs, the result were even better. Therefore, It is suggested that Arginine and Lysine requirement of the Baladi chickens could be around 1.5 % and 1.2 %, respectively. It is also suggested that further physiological studies are needed to investigate the relationship, if any, between Arginine inclusion, egg production and lueitnizing hormone (LH) level. Further study is also, needed to determine the best combination levels between arginine and lysine for Baladi layers.

diet since it was only one level. This area needs further investigation using different levels of arginine and different levels of lysine for the Baladi birds.

Baladi birds. 1.27 % lysine in the diet was fed to the birds at 45 weeks of age. The result of this experiment is presented in table 4.

It is obvious that addition of lysine to the diet already fortified with extra arginine has numerically (not significantly) improved the production rate in all the treatments, except the 2.5 % arginine treatment which was already at the bottom line in experiment 1 as shown in table 3. The highest increase (67.86 %) was observed in birds fed 1.5 % arginine as those were also the best producers under the same treatment in Experiment 1 (table 3). This higher production rate in experiment 2 was partially the reason for better egg mass and feed conversion in birds fed 1.5 % arginine.

Egg production of the control birds reflected the normal production rate of Baladi birds at this age (unpublished data).

The lack of the significance among the means of the production parameters (HD, EW, EM, FC and FI), in spite of the clear numerical differences, could be due to the smaller error degrees of freedom (15) which were occurred as a result of smaller number of observation (20), since the experiment lasted only 4 weeks.

The response of hen-day production to the treatments showed a weak linearity but a strong quadratic effect.

Egg components were also determined in this study. No clear response to the treatments was exhibited, except for few points, worth mentioning.

Yolk index, which is the function of yolk height and diameter, was the highest in birds fed 2 % and the lowest was in birds fed 1.5 %. The result in case of 1.5 % arginine level can be explained by the smallest yolk weight, they laid (table 4). Birds normally produce eggs in chains. The first yolk in a long chain is the largest and as chicken progress in lay, the yolk gets smaller toward the end of the chain (North, 1984). These birds also had the highest production rate, which mean longer chains. The cause for larger yolk index in 2 % arginine treatment level is not clear and open for speculation.

As mentioned earlier, level of lysine added to the diet was 0.5 %. This level may or may not be the optimum level to be used with higher arginine

of egg shell materials throughout her life and as egg get progressively large, the shell material must be spread over a large area, and thus become thinner. The effect of treatments on Haugh unit was not showing any sign of significance, neither was any linearity or quadratic response (table 3). Height of Albumen of the Baladi eggs was comparable to those reported with other batches of Baladi birds raised here in this institute. However, these figures were much lower than those given by the white leghorn (Unpublished Data).

Table (3)

Effect of adding excess arginine in the Baladi layer's diet[1]

Source of Variation	GBD	HD	FC	EW	LIV	SPG	HU
TRT Level, %[2]	**	**	**	**	NS	*	NS
0	112.2[a]	56.97[a]	5.118[b]	40.75 [b]	99.63[a]	1.094[a]	88.89[a]
1	112.3[a]	51.70[b]	5.652[a]	40.66 [b]	99.48[a]	1.093[ab]	88.53[a]
1.5	110.2[a]	59.22[a]	4.855[bc]	40.55 [b]	99.51[a]	1.092[bc]	88.66[a]
2	102.3[b]	55.76[ab]	4.649[c]	41.99[a]	99.74[a]	1.091[c]	89.01[a]
2.5	101.4[b]	51.65[b]	5.299[ab]	39.62 [b]	100.0[a]	1.092[bc]	88.90[a]
P	0.0001	0.0005	0.0001	0.0006	0.572	0.0017	0.8853
± SEM	0.910	0.680	0.070	0.175	0.110	0.0002	0.164
Linear	0.0006	0.5034	0.3704	0.0535	0.3244	0.0041	0.8908
Quad.	0.8075	0.3458	0.0725	0.0020	0.3887	0.0074	0.7802

[1]Means within columns having different superscripts, are significantly different, $P<0.05$

[2] Level of arginine in the diets; TRT, treatment; GBD, gram/bird/day feed intake; HD, % hen-day production; FC, kg/feed/kg eggs, feed conversion; EW, gram egg weight; LIV, % livability; SPG, specific gravity of the eggs; HU, haugh unit.

Experiment 2:

Due to the fact that amino acid antagonism is existed between arginine and lysine as reported by D'Mello and Lewii (1970), therefore, a short term experiment was conducted to determine if adding lysine in extra amount above that already in the ration would further improve the production of the

Feed conversion was slightly improved in the birds fed 2 % arginine (4.649 kg/kg) and that did not statistically differ from those fed, 1.5 % (4.855 kg/kg). High production rate (55.76 %) , lower feed intake (102.3 g/h/d) and larger egg size (41.99 gm) were the reasons for the improvement of feed conversion in birds fed 2 % arginine while the significantly higher production rate (59.22 %) was solely the reason for the improvement of feed conversion in birds fed 1.5 % arginine. Calculation of feed conversion is dependent on number of eggs produced during certain period of time, feed intake during the same period and average egg weight (North, 1984).

Response of egg weight to the treatment levels was highly significant ($P<0.001$) (Table 3). Furthermore there was an insignificant linear trend in the response of egg weight to the treatments ($P>0.05$) (Table 3). The largest egg weight was found in birds fed 2 % arginine and that was significantly different from all other treatments including the control. However, in general, egg weight of the birds under investigation was smaller than their counterpart the white leghorn. These birds had never been in any genetic improvement program. Unpublished data from this institute on three generations of Baladi birds during the years from 1991 to 1995 showed that average egg production was ranged from 37 to 52 % and egg weight from 43 to 45 gm.

Livability estimate of the birds fed different levels of arginine showed a close figures in all treatments (Table 3) which indicate that level of arginine had no effect on the survival rate of the birds.

Specific gravity of the eggs was highly affected by the treatment level ($P<0.01$) also showing strong linearity ($P<0.01$) in response to the treatments. It is obvious that with exception of 2.5 % level which probably caused the quadratic effect ($P<0.01$), there was a decline in specific gravity values as levels of arginine increased from 0 to 2 % (Table 3). These values, even, with the lowest specific gravity (1.091) are still better than most values seen in eggs of their counterpart, the White Leghorn, fed untreated diet (Najib *et al*., 1994 and Najib, 1994). Therefore, this result would not impose any problem to the Baladi birds since their higher specific gravity could be attributed to the genetically small eggs they produce. It was hypothesized that the hen is capable of generating a uniform daily quantity

80 mg; ethoxyquin, 56 mg; Cu, 12 mg; I, 0.8 mg Fe, 40 mg; Mn, 80 mg Zn, 48 mg; Co, 0.04 mg; Se, 0.16 mg.

Results and Discussion:

Experiment 1.

The results of this study are presented in table 3. Data of this study provided evidence that inclusion of arginine in the Baladi layer diets in quantities exceeded that of the leghorn requirement (0.75 %) (NRC, 1994) had a significant effect on feed intake ($P<0.001$), hen-day egg production ($P<0.001$), feed conversion ($P<0.001$), egg weight ($P<0.001$), and specific gravity ($P<0.01$). Test of linearity has also shown a significant linear trend of feed intake and specific gravity ($P<0.001$ and $P<0.01$, respectively).

The treatment levels of arginine significantly ($P<0.001$) affected feeding pattern of the Baladi birds. It was clear that daily feed intake of the birds were linearly decreased proportional to the increasing levels of arginine from one to 2.5 % (Table 3). There is no doubt that this effect was due to the treatments. The biggest drop in feed intake was in birds fed arginine exceeding 1.5 % (Table 3) which probably indicates that higher levels of Arginine may impair the palatability of the feed. This change in feed pattern was reflected on the performance of the birds, under these treatments (2.0 % and 2.5 %).

Level of arginine had a significant effect on egg production. Although, the response of egg production to the treatment levels was inharmonious and somehow inexplicable such in case of 1 % arginine level, there seems to be a trend that increasing level of arginine beyond 1.5 % would deteriorate the production rate of the bird. The best production rate was found in birds, fed 1.5 % arginine. However, that was not statistically different from that of the control. This result is surprising since feed intake of the bird fed 1.5 % arginine was not the highest. It is conceivable however, that level of arginine might have made the difference. There is very limited findings to support or contradict this result.

The lowest production rate was found in birds, fed 2 % arginine. No doubt this was due to the lowest feed intake the birds experienced under this treatment which could be due to palatability. The loss of linearity ($P>0.05$) in egg production response could be due to the inconsistency of the response.

Table(2)

Feed ingredients and composition of the experimental diets.

INGREDIENTS %	DIETARY TREATMENTS				
	0 % (CONTROL)	1 %	1.5 %	2.0 %	2.5 %
YELOW CORN	61.90	60.0	58.00	58.30	57.66
SBM, 44	26.31	26.20	26.20	26.70	26.80
WHEAT BRAN	1.0	2.5	3.5	2.00	2.00
LIMESTONE	8.38	8.34	8.33	8.42	8.30
MVMIX*	0.20	0.20	0.20	0.20	0.20
DICAL PHOS.	1.0	1.0	0.95	1.01	0.98
SALT	0.40	0.40	0.40	0.40	0.40
CORN OIL	0.80	1.3	1.85	1.84	2.03
ANTIOXIDANT	0.01	0.01	0.01	0.01	0.01
ADDED ARGININE	0.00	0.1	0.60	1.1	1.60
TOTAL	100	100	100	100	100
CALCULATED COMPOSITION					
PROTEIN, %	17.00	17.00	17.00	17.00	17.00
ME, Kcal/Kg	2750	2750	2750	2750	2750
CALICIUM, %	3.51	3.50	3.50	3.52	3.50
AVAILABLE PHOSPHORUS, %	0.30	0.30	0.30	0.30	0.30
RIBOFLAVIN, mg/kg	1.43	1.47	1.50	1.45	1.45
NIACIN, mg/kg	24.35	26.63	28.03	22.44	25.32
PANTOTHENIC ACID, mg/kg	7.00	7.36	7.10	7.22	7.21
CHOLINE, mg/kg	1131	1133	1134	1131	1130
METH+CYST., %	0.57	0.57	0.56	0.56	0.56
LYSINE, %	0.77	0.76	0.76	0.78	0.79
ARGININE, %	0.89	0.99	1.49	1.99	2.49
LINOLEIC A.,%	1.48	1.48	1.44	1.42	1.41

*Multivitamins and minerals premix provided the following per kilogram of diet: vit. A, 12000 IU; vit. D_3 , 6000 ICU; vit. E, 8 mg; choline chloride, 20 mg; vit. K, 1.6 mg; vit. B_6, 0.8 mg; niacin, 20 mg; pantothenic acid, 8 mg; folic acid, 0.8 mg; biotin, 0.08 mg; vit. C,

amino acids profile of the basal diet was as follows; aspartic acid, 1.39 % ; therionine, 0.58 % ; serine, 0.68 % ; glutamic acid, 2.78 % ; glycine, 0.63%; alanine, 0.78 % ; valine, 0.68 % ; methionine, 0.28 ; isoleucine, 0.60 % ; leucine, 1.32 %; tyrosine, 0.50 % ; phenylalanine, 0.78 % ; histidine, 0.43 % ; lysine, 0.77 and arginine, 0.89 %.

Each of the treatments was replicated 5 times in experiment 1, and 3 times in experiment 2. Birds were distributed randomly among cages, each containing 4 pullets in both experiments.
Birds were weighed individually at the beginning of the experiment and then periodically on a bi-weekly basis. Each two weeks were considered as a period in experiment 1, and each week was considered as a period in experiment 2. Eggs were collected daily however, calculation of hen-day production was based on two weeks collection of eggs in experiment 1 and one week collection in experiment 2.

Egg weight, albumen height and specific gravity of the eggs were performed on three days collection at the end of each period. Feed was given ad-libitum to the birds as needed. Feed left was measured to determine feed intake. The duration of experiment 1 was 24 weeks while experiment 2 started after the termination of experiment 1 and lasted for 4 weeks.

Data were analyzed as pooled means of the periods. They were subjected to analysis of variance using the GLM procedure of SAS® (SAS institute, 1986). Differences among the means were detected using Duncan Multiple Range Test and the orthogonal comparison contrast as described in Steel and Toori (1980). The statistical model used was :

$$\mathbf{Y_{ij} = \mu + t_i + e_{ij}}$$

Where;
Y_{ij} is the measurement of j^{th} pen on the I^{th} treatment
μ is the overall mean
t_i is the effect of i^{th} treatment , i , 1,……5
e_{ij} is the random error associated with the i^{th} pen assumed normally distributed with zero mean and variance $\sigma^2 I$

3˚C each following week. During the rest of the growing period, the temperature remained within the comfortable zone (24 – 27 ˚C). Lighting cycle was maintained for 9 hours daily using artificial lights, if necessary. These procedures were done according to North (1994). Debeaking procedure was done twice during these periods, at week 9 and 16. The birds were also vaccinated according to the vaccination program of this area. During the period from hatching to 5 % production , the pullets were fed commercial starter and grower diets. These diets are presented in table 1.

Table (1)
The chemical constituents of the starter and grower diets

Nutrients	starter	grower		pre-lay
	0 – 4 wk	5 – 11	12 - 17 wk	18 wk–5 % Production
Crude Protein, %	19	18	16	18
Metabolizable Energy (ME), Kcal/Kg	2900.0	2850.0	2800.0	2800.0
Ca, %	1.0	1.0	1.0	2.5
P (available), %	0.45	0.45	0.44	0.44

On week 19, 100 pullets were moved to cages in a house where cooling device was installed. In this house, the birds were fed the dietary treatments.

Four levels of arginine, 1, 1.5, 2 and 2.5 % of the diet and a control (0% added arginine) were used in experiment (1). The amounts of supplemented arginine were estimated to cover the differences between the level of arginine found in the basal diet (0.89 %) and the proposed levels of arginine (1, 1.5. 2 and 2.5 %). In the second experiment, the same treatments were used plus adding 0.5 % lysine to the basal diet (control) to bring up the level of lysine to 1.27 %.

Composition of the experimental diets is presented in table (2). The

Introduction:

Production of Baladi chickens is far behind that of foreign breeds (Al-Aqil, 1998) . A considerable amount of work has been carried out to improve the production in this breed. Najib (1994) showed that average hen-day production for Baladi layers may increase up to 44 % when 18 % protein level was used in the ration, while using 16 % deteriorate the production to 37 %. Later, Al-Yousef and Najib (1997) demonstrated that as level of protein increased from 13 to 17 % in Baladi diet, hen-day egg production was increased from 41 % to 48 %. These data have clearly demonstrated that increasing protein level resulted in an increased rate of production which probably indicate that Baladi bird has the potentiality to improve it's production by manipulating protein intake and it's components, the amino acids.

Arginine, an essential amino acid for chicken, is known for it's role in the protein metabolism (Scott *et. al*., 1982) . Recently, Takahashi *et. al.* (1994) reported that arginine, as part of the hormone arginine vasotocin, (neurohypophysial hormone) plays an important role in the initial contraction of hen's uterus through an increased binding to it's receptor. The process of oviposion in hen involves the contraction of the uterus and the oviduct, sending the egg to the vagina and expelling the egg out through the cloaca (Sykes, 1953). It was also used intravenously in prepubrtal does and ewes to enhance the release of luteinizing hormone (LH), which is a pituitary hormone responsible for the induction of ovulation in farm Animals (Recabarren *et. al*., 1996 and Basiouni *et. al.,* 1999). If this true for large animals, then feeding arginine in excess of the requirement to layers hypothesized to enhance the release of folicle stimulating hormone (FSH) and luteinizing hormone (LH) which may stimulate egg production.

These studies were carried out to investigate the effect of increasing levels of arginine and lysine , beyond the NRC requirement of the leghorn layer on production parameters of Saudi Baladi layers.

Materials and Methods:

Two hundred Baladi day-old chicks were brought from a local source to grower house and kept under gas hoover for 4 weeks. During this period, temperature was maintained at 32 ˚C during the first week and lowered by

Determination of the Nutritional Requirements of the Baladi Chickens: 1. Effect of Arginine Inclusion (in Excess of the Leghorn Requirement) on Performance of the Saudi Baladi Chickens

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Abstract:

Arginine is known to enhance the release of lutenizing hormone (LH) that is responsible for induction of ovulation in farm animals. Feeding arginine in excess of layers' requirement may enhance egg production in weak producers.

In an attempt to enhance the egg production of Baladi layers by feeding arginine in excess of leghorn requirements and to assess Baladi performance when arginine accompanied with high lysine level. Two experiments were conducted; one involved four levels of arginine and a control. In the second experiment, the same treatments were used, but Lysine level was raised by 0.5 % in the basal diet. Results of the investigation revealed; raising the arginine level to 1.5 % improved egg production (59.22 %) and feed conversion (4.88 kg/kg) compared to the other treatments. However, negative linear response was observed in feed intake and specific gravity of the eggs when arginine increased from 1 - 2.5 %, and from 0 – 2.0 %, respectively. Increasing level of lysine to 1.2 % in diet, improved egg production (67.86 %) and feed conversion (2.943 kg/kg) of the group fed 1.5 % arginine. No significant effect was found on egg components, except yolk weight, in the 2.5 % arginine fed groups.

It was concluded that arginine and lysine requirement of the Baladi chicken could be around 1.5 % and 1.2 % respectively.

Key Words : Arginine, lysine, performance, Saudi Baladi chickens

كفاءة الكوالين و الفحم النشط فى تقليل سمية معدل بسيط من الأفلاتوكسين فى علائق بدارى التسمين

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كلية الطب البيطرى و الثروة الحيوانية – جامعة الملك فيصل

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الملخص :

تم ادماج الكوالين و الفحم النشط كعوامل ضامة فى العليقة عند مستوى 0.5٪ و ذلك لتقييم قدرتهما على تقليل ألأثر الضار ل 30 جزء فى البليون من سموم ألأفلاتوكسين الكلية فى علائق كتاكيت بدارى التسمين. فقد قسمت 320 كتكوت بدارى تسمين عمر يوم واحد الى 4 مجموعات متساويه وهى مجموعه ضابطه ومجموعه عليقتها ملوثة بالافلاتوكسين و مجموعه عليقتها ملوثة بالأفلاتوكسين ومعها كوالين و مجموعه عليقتها ملوثة بالأفلاتوكسين و معها الفحم النشط. و أظهرت الكتاكيت التى تغذت على عليقة تحتوى على 30 جزء فى البليون لمدة 45 يوم متتالية نقص معنوى فى وزن الجسم الحى طوال فترة التجربة و 20٪ وفيات. وأن اضافة الكوالين و الفحم النشط الى العليقه بمستوى 0.5٪ قلل من معدل الوفيات و حسنت فى زيادة وزن الجسم و كفاءة الاستفاده من العليقه.

كما وأظهر الفحص النسيجى المرضى أن أكباد الطيور فى كل المجموعات ما عدا المجموعه الضابطه بها تنخر بؤرى للكبد و تكثر نسيجى طلائى صفراوى وأورام حبيبية بنسب مئوية متفاوتة بينما كان أعلى معدل للحدوث يوجد فيما بين المجموعه التى تغذت على العليقه الملوثة بالأفلاتوكسين.

ولم يتم اكتشاف اى متبقيات للأفلاتوكسين فى الكبد و عضلات الصدر والفخذ و القلب فى جميع مجموعات التجربه.

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Fig. 4 : Focal area of hepatic necrosis in chicken fed 30 ppb AF for 45 days. (H & E. X 100)

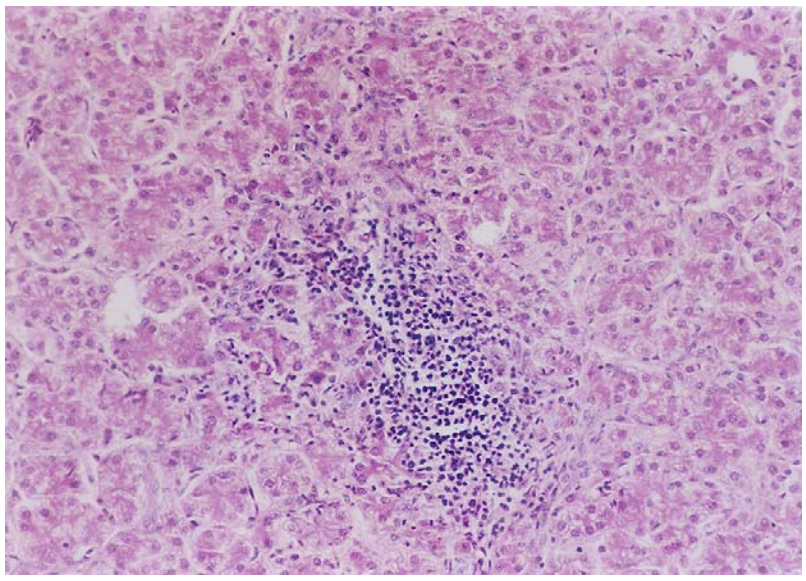
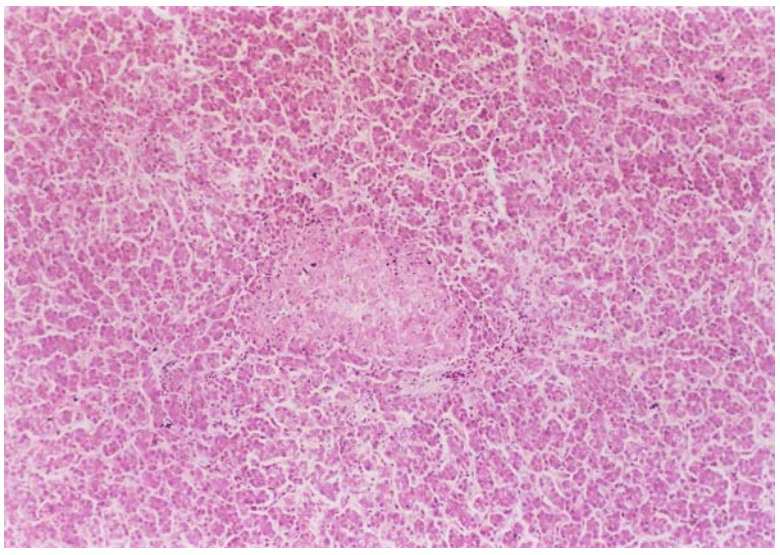


Fig. 3 : Parenchymal and mononuclear cell aggregation in liver of chicken fed 30 ppb AF contaminated diet. (H & E. X 200)



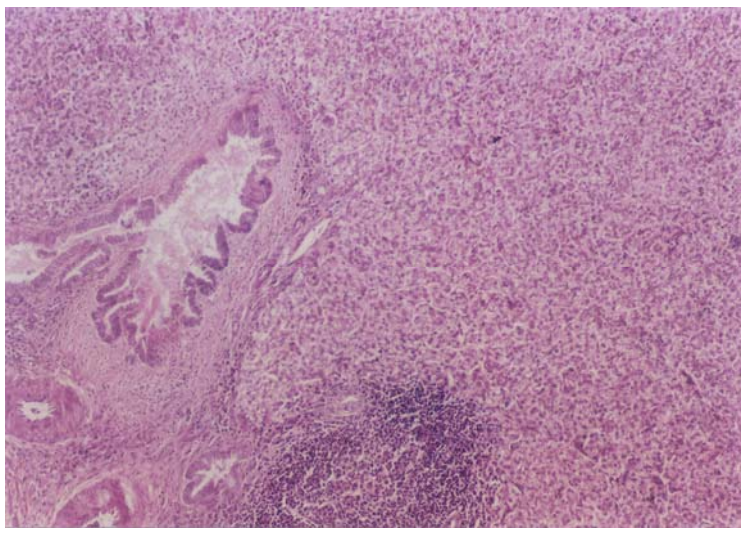


Fig. 1: Bile duct proliferation associated with fibrosis and granuloma in the liver of chicken fed 30 ppb AF for 45 days. (H&E. X200).

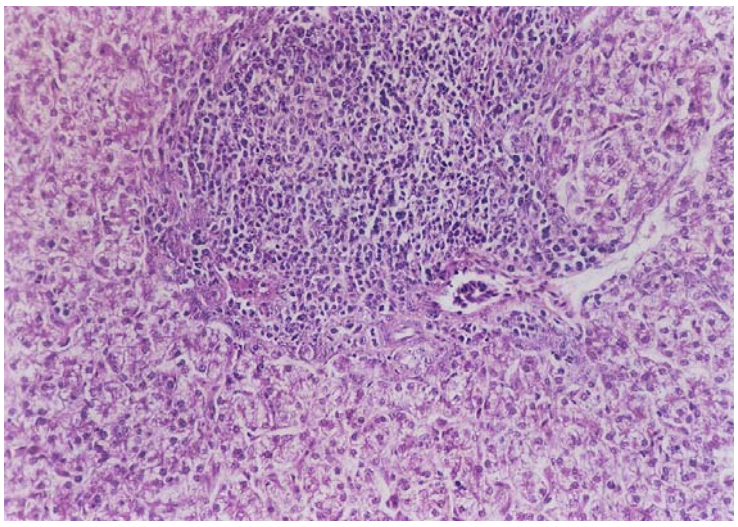


Fig. 2: Hepatic cell vacuolation and granulomas in chicken fed 30 ppb AF contaminated diet for 45 days. (H & E. X 200)

dosages ranging from 0.4 to 1.7 g. of mixed AF/kg for six weeks. The authors failed to detect AF residues at slaughtere. Similar results were recorded in other animal species, such as swine and steers Booth (1969). The analytical methods used have a minimum detection limit in the order of three to five μ g AF/kg of sample.

The bursa of fabricous showed lymphoid depletion in group 2 chicks treated with AF alone Similar results were obtained by Kubena *et al.* (1990), Kececia *et al.* (1995) and Kiram *et al.* (1998). It is apparent that the absorption therapy reduced the deleterious effect of AF on lymphoid tissue as no change could be detected in the bursae of birds of kaolin or charcoal treated groups. The number of affected chicks and the severity of lesions in the liver were reduced after addition of kaolin and activated charcoal; thus it can be concluded that both adsorbant may have a noticeable effect in reducing AF toxicity in the liver . Further work should be carried out using different AF concentrations and kaolin or charcoal regimens in order to make use of this observation.

considered the principle target organ for aflatoxicosis (Dalvi and Ademoyero,1984). The principle lesions observed in this study occurred in the liver. It is classified as toxic hepatitis where hepatic cells vacculization, fatty changes, biliary hyperplasia, portal fibrosis, and granuloma were the predominant changes. These agreed with data reported for chicken (Kubena *et al.,* 1990; Espada *et al.,* 1992). Aflatoxin B induced an accumlation of lipids in the liver and can be explained according to Huff *et al* (1985) by an increase in the concentration of liver lipids. This increase may be due to general inhibition of lipid transport (Tung, *et al.,* 1972) or from interference of lipogenesis (Donaldson *et al.,* 1972). Fatty changes in the liver of two birds treated with kaolin was observed after 35 days of treatment and disappeared at 45 days. Perihepatitis was observed in two cases of group 3 chicks treated by kaolin after 35 days of treatment is of doubtfull significance in relation to AF treatment as well as to kaolin. It was absent at 45 days of treatment with kaolin or diet without kaolin.There is no available data concerning the effect of AF with koalin or activated charcoal on relative weight of heart and spleen. However, as can be seen from table 2, there was a moderate increase in the relative weight of these organs in AF fed chicks (groups 2, 3, and 4). The increase in the relative weight of spleen might be a compansatory mechanism for the drop in weight (and activity) of the bursa of fabricius. The relative weight of bursa of fabricous was flactuating throughout the experimental period, and was much lower (0.04-0.17 g) than the weight (0.55-0.63 g) reported by Kubena *et al.* (1990), who observed birds up to day 28 of age. A decrease in relative weight of bursa of fabricous in chicken fed AF contaminated diet or AF contaminated diet plus charcoal was also reported Kubena *et al.* (1993) and could be attributed to an immunosuppressive effect of AF.

There were no detectable of AF residues in spiecemens of breast and thigh muscle, heart, and spleen from birds slaughtered at all stages. These results are parallel to those recorded by others . White Leghorn laying hens fed a diet containing 2.7 m g/kg for seven weeks had no AF residues in the eggs muscle, or liver (Kratzer *et al.*, 1969). Laying hens were exposed to AF by two methods: the first involved graduated dietary levels of zero, two, four, and eight mg/kg; the second, oral administration of 120, 240 and 480 μ g/kg. of body weight. No AF residues were detected (Sims *et al*., 1970). Likewise, Van zytveld *et al.* (1970) exposed White Rock chicks to daily

Discussion:

In this study, experimental aflatoxicosis was induced in broiler chickens by feeding 30 ppb AF/kg diet from one day old until 45 days old. In intoxicated broilers a significant decrease in body weight gain and efficiency of feed utilization as well as high mortality was observed. These results are in agreement with those of Bailey *et al.* (1998) and Kubena *et al.* (1998). The adverse effect of AF can be shown to inhibition of metabolizing capacity (Dalvi and Ademoyero, 1984), protein and nucleic acid synthesis (Smith and Hamilton, 1970) and suppress mitosis and DNA synthesis (Legator, 1966). These may explain the nucliobiotic changes, which were seen in the livers of AF, treated birds.

The present study shows that addition of either kaolin or activated charcoal to AF contaminated diet tends to improve the body weight gain and feed utilization. Similar effects were reported by Dalvi and Ademoyero (1984) and Dalvi and McGown (1984). In contrast to these results, Kubena *et al.* (1990) reported that the addition of activated charcoal to the diet did not appear to have protective properties against the effect of AFB1. The level of AF used in this work was very low 30 μ g/ kg compared to level of 10 ppm used by Delvi and Ademoyero (1984). Activated charcoal is non-adsorbable carrier that adsorbe to toxic molecules, thereby eliminating their absotrption from the intestinal tract. Kubena *et al.* (1990) reported that addition of activated charcoal to AF contaminated diet increases mortality rate in chicken compared to those fed AF contaminated diet only, so activated charcoal may have actually exacerbated the toxic effect. This has not been observed in this study, as group 4 chicks fed charcoal plus AF contaminated diet had less mortality than either groups 1, 2 and 3 which were either fed AF contaminated diet alone or with kaolin. The histopathological lesions were also less severe in groups 4 and 3 than AF fed chicks (group 2).

The present data shows that the relative weight of liver was significantly increased for chicks consuming AF than those fed AF with addition of either kaolin or activated charcoal. Huff *et al.* (1986) and Kubena et al. (1990) reported similar effect on relative weight of liver. These increases in relative weight of livers may be due to liver damage, as this organ is

charcoal showed fibrinous perihepatitis (2 cases) moderate to diffuse areas of hepatic vacular degeneration, hyperplasia of bile ducts occassionally associated with fibrosis. Portal mononuclear and hetrophilic cell aggregation were also seen. These changes were observed after 35 days of treatement (Table 3)

Table (3)

Effect of addition of koalin and activated charcoal on histopathological lesions

	AF		Koalin		Charcol	
	35d.	45d.	35d	45d	35d	45d
Fibrinous Perihepatitis Fatty changes			 2		2	
Hepatic degeneration a. Focal area b. Diffuse	 3	 1 	 1 1	 2 1	 3	 2
Billiary hyperplasia	3	1	2	1	2	
Fibrosis	2	1		1	2	1
Hepatic necrosis a. Focal b. Diffuse	 3 	 1 1	 3 1	 3 	 3 	 1
Focal infltration with Mononuclus cells Hepatic infiltration	3	2	2	1	2	2
Parenchymal Granuloma	3	1	3		1	
Gall blader hyperplasia	2		1			
Hepatic heamorrhage And thromb			1			
Hepatic dissociation And cellular atrophy			2			
Kupffer cell Proliferation		1				
Congestion		1				
Bursa lymphoid Depletion		1				
Heart focal area of necrosis		1				

Table (2)

Effect of kaolin (0.5%) and activated charcoal (0.5%) on relative weight (g) of internal organs of chicken fed diets containing 30 ppb aflatoxin for 45 day

	AF 30 pp b	K 0.5%	C 0.5%	liver			heart			Spleen			bursa		
				20 d	35 d	45 d	20 d	35 d	45 d	20 d	35 d	45 d	20 d	35 d	45 d
Group 1	-	-	-	3.23^{a} ± 0.07	2.46^{a} ± 0.1	2.3^{a} ± 0.2	0.15 ± 0.03	0.41^{a} ± 0.02	0.4^{a} ± 0.03	0.19^{a} ± 0.003	0.4 ± 0.003	0.09^{a} ± 0.002	0.13^{a} ± 0.04	0.07^{a} ± 0.01	0.05^{a} ± 0.02
Group 2	+	-	-	3.89^{b} ± 0	2.99^{a} ± 0.41	2.69^{a} ± 0.52	0.58 ± 0.06	0.48^{a} ± 0.06	0.4^{a} ± 0.04	0.14^{a} ± 0.003	0.15 ± 0.004	0.07^{a} ± 0.006	0.17^{a} ± 0.06	0.07^{a} ± 0.04	0.06^{a} ± 0.02
Group 3	+	+	-	3.14^{a} ± 0.3	2.69^{a} ± 0.53	2.45^{a} ± 0.4	0.45 ± 0.04	0.44^{a} ± 0.03	0.37^{a} ± 0.05	0.2^{a} ± 0.003	0.34 ± 0.005	0.08^{a} ± 0.003	0.15^{a} ± 0.05	1.1^{b} ± 0.1	0.05^{a} ± 0.01
Group 4	+	-	+	2.99^{a} ± 0.12	2.51^{a} ± 0.33	2.48^{a} ± 0.46	0.54 ± 0.03	0.43^{a} ± 0.05	0.43^{a} ± 0.06	0.11^{a} ± 0.002	0.18 ± 0.007	0.08^{a} ± 0.004	0.14^{a} ± 0.07	0.05^{a} ± 0.02	0.04^{a} ± 0.004

a,b : means within a column with no common superscript letters are significantly different ($P \subseteq 0.05$)

weight gain) was lower ($P \subseteq 0.05$) in group 2 chicks fed AF contaminated diet than the control group. Both groups 2 and 3 chicks fed AF contaminated diet plus either kaolin or activated charcoal showed similar values. Regarding mortality rate, chicken fed AF contaminated diet had the highest mortality rate of 20% followed by chicken fed AF contaminated diet and treated by kaolin or activated charcoal (Table, 1). No relevant macroscopic post mortem changes were observed at necropsy.

Data presented in Table (2), show the effect of dietary treatments on relative weight of liver, heart, spleen and bursa of fabricous. Feeding a diet contaminated by 30 ppb AF resulted in a significanct increase in relative weight of liver at 20 days of age compared to other dietary treatments. There was non-significant increase in liver weight throughout the rest of the experimental period. A significant increase was recorded in weight of bursa of fabricous at 35 days of age, in group 3 chicks fed AF contaminated diet plus kaolin. No significant difference was observed in relative weight of heart or spleen in all groups throughout the experimental period.

No AF residues were detected in specimens of breast and thigh muscles, heart, and spleen from birds slaughtered at 20, 35 and 45 days of age.

It is clear that the type of the lesions were similar in all groups, where as the incidence and severity of lesions were comparatively less common in groups treated with kaolin or activated charcoal. The liver of all chicken consuming diet contaminated by 30 ppb AF showed diffused areas of hepatic vacuolar degeneration. The hepatocytes appeared swollen, vaculated with pycknotic nuclei. Bile duct proliferation occussionaly associated with fibrosis, granuloma and periportal aggregation of mononuclear cells and hetrophils and kupffer cell proliferation was observed in the liver (Fig.1). Hyperplasia of epithelial lining of gall bladder was detected in two cases. Lymphoid depletion of bursa of fabricous was also seen. In group 3, chicks fed diet containing 30 ppb AF and 0.5% kaolin, there were focal areas of hydropic degeneration (Fig. 2). Fatty infiltration was detected in two birds. Hyperplasia of bile ducts, granulomas, focal areas of portal and parenchymal aggregation of mononuclear cells (Fig. 3) and hetrophils in association with hepatic necrosis (Fig. 4) and kupffer cell hyperplasia were observed in individual cases at 35 and 45 days of age. The hepatic lesions of chick fed diet containing 30 ppb AF and 0.5% activated

Table (1)

Effect of Koalin (K) and activated charcoal (C) on body weight gain ,
Efficiency of feed utilization and mortality (%) of broilers fed 30 ppb AF for 45 days

Basal diet	AF 30ppb	K 0.50%	C 0.50%	Initial body weight (g)	Final body weight (g)	Body weight gain (g)	Change from control (%)	Feed efficiency kg/kg	Mortality %
Group 1	-	-	-	$41.2^{a} \pm 1.0$	$1450.8^{a} \pm 95.0$	$1408.8^{a} \pm 90.3$	0	$2.4^{a} \pm 0.15$	2
Group 2	+	-	-	$40.9^{a} \pm 1.2$	$1350.0^{b} \pm 210.0$	$1309.6^{b} \pm 151.6$	-7.04	$3.2^{b} \pm 0.9$	20
Group 3	+	+	-	$39.9^{a} \pm 1.1$	$1410.0^{a} \pm 105.0$	$1370.1^{a} \pm 101.0$	-2.74	$2.7^{a} \pm 0.18$	15
Group 4	+	-	+	$40.1^{a} \pm 0.9$	$1440.0^{a} \pm 110.0$	$1399.9^{a} \pm 99.2$	-0.63	$2.8^{a} \pm 0.11$	12

Values represent the ($\overline{X}$ = SEM) of 15 broilers per treatment.
a,b : means within a column with no common superscript letters are significantly different ($P \subseteq 0.05$)

weight gain was not significantly influenced when both kaolin and activated charcoal were added to the diet contaminated with AF compared with control basal diet group. The efficiency of feed utilization (kg feed / kg body

Aspergillus flavus was grown on corn meal as described by Harvey *et al.* (1989),and Kubena *et al.* (1990 & 1993) . The contaminated AF corn was analyzed for AF content using Thin Layer Chromatography (TLC) Samuel (1978). The contaminated corn was incorporated into diets every three days to achieve the desirable concentration of 30 µ g total AF/ kg of feed.

Experimental design:

The experimental chicks were allocated into four groups of 80 chicks each. Each group was fed as follows: group 1, control basal diet; group 2, basal diet plus 30 µ g AF /kg; group 3, basal diet plus 30 µ g AF / kg plus 0.5% kaolin; group 4, basal diet plus 30 µ g AF / kg plus 0.5% activated charcoal (Table 1).

Birds were observed daily for mortality and adverse clinical signs throughout the experimental period. Feed consumption and body- weight were determined weekly. On days, 20, 30, and 45 (end of experiment) 5 chicken of each group were weighed and slaughtered. A detailed necropsy was performance. The liver, spleen, bursa of fabricous and thymus were weighed. Specimens of these organs were collected in 10% neutral buffer formalin and processed for histopathology by standard paraffin method. Tissue sections of 3.5 µm thickness were cut and stained with haematoxylin and eosin. Samples of breast and thigh muscles, heart, and liver were analysed for AF residue using TLC technique according to the method of Stzelecki (1978).

Statistical analysis:

The data for live body- weight, body- weight gain, feed gain and relative weight of internal organs were expressed as mean + pooled standard error of means. Statements of statistical significane were based on $P \subseteq 0.05$, using analysis of variance.

Results:

There was a significant ($P \subseteq 0.05$) reduction in body -weight gain (7%) in chicken fed diet contaminated with 30 ppb AF compared to the control group. The decrease in body weight gain caused by AF was diminished by addition of 0.5 % of either kaolin or activated charcoal (Table, 1). Body

legislation for the control of mycotoxicosis in both humen and animal feed (Vanegmond, 1995). There is no effective way of destroying mycotoxin once is formed. Practical and effective methods to detoxify AF containing feedstuffs are in great demand. A variety of physical, chemical and biological approches have beenrted (Goldblatt and Dollear, 1979; Andrson, 1983; Smith, 1984; Philips et al., 1988; Gazia *et al*., 1991; Park, 1993 and Santurio *et al*., 1999). Another approach to the problem has been to use non-nutritive and inert adsorbents in the diet to bind AF and reduce their absorption from gastrointestinal tract. These compounds must not be absorbed from gastrointestinal tract and must have the ability to bind physically with the chemical substances and precludes their absorption. The major advantages of these adsorbents include expense, safety, and easy administration through addition to the animal feed (Ledoux *et al*., 1999). Zeolites (hydrated sodium calcium aluminosilicat (Kubena *et al*., 1993 & 1998; Kececi *et al.*, 1998; and Ledoux *et al*., 1999), activated charcoal (Dalvi and Ademoyero, 1984; Dalvi and McGowan, 1984; Kubena et al., 1993 & 1998) and clinoptilolite (Oguz *et al.,* 2000) have been used for this purpose. Food and Drugs Administration (FAD) of the United States of America estimated 20 ppb as tentative maximal allowance tolerance of AF in broiler feed. The objectives of this study were to evaluate the efficiency of two binding agents (kaolin and activated charcoal) for protection against low-level Aflatoxicosis, in broiler chicken. Growth performance, histopathological change, and AF residue in the edible meat were utilized as evaluatory parameters.

Materials and Methods

Chicken and diets

Three hundred and twenty of one-day old broiler chicks (Hubbard) of both sex obtained from a commercial hatchary were used in this study. Ckicks were individually weighed and divided randomlly into four equal designated groups 1, 2, 3 and 4. Chicks were allowed access to feed and water *ad libitum* . Basal diet was formulated according to the National Research Council (NRC, 1994) requirement. The basal diet was tested for possible residual AF before feeding (Samuel, 1978). The experiment lasted 45 days.

Aflatoxin preparation:

Efficiency of Kaolin and Activated Charcoal to Reduce the Toxicity of Low Level of Aflatoxin in Broilers

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Abstract :

Kaolin and activated charcoal were incorporated at 0.5% in diet to evaluate their ability to reduce the deleterious effects of 30 ppb total *aflatoxin* (AF) in broiler chicken. A total of 320 one-day old broiler chicks were divided into 4 equal treatment groups (control, AF contaminated, AF plus kaolin and AF plus activated charcoal). Chicken fed on diet containing 30 ppb AF for 45 days showed a significant decrease in live body weight and body weight gain with 20% mortality rate. Adition of kaolin and activated charcoal to the AF contaminated diet at 0.5% level reduced the mortality rate and improved body weight gain and efficiency of feed utilization. Histopathologicaly, the livers of birds of all groups except the control one showed focal hepatic necrosis, biliary epithelial hyperplasia, and granulomas. Pathological changes were highest among AF treated group. No AF residue could be detected in liver, breast, thigh and heart muscles in all birds.

Introduction:

Aflatoxin (AF), a group of closely related extremely toxic chemicals, are produced by *Aspergillus flavus* and *Aspergillus parasiticus*. They can occur as natural contaminants of poultry feeds. The contamination of agricultural products with fungi that are able to produce mycotoxin is often unavoidable. Mycotoxins cause a wide variety of adverse clinical signs depending on the nature and concentration of mycotoxin, duration of exposure, animal species, and age and nutritional and health status at the time of exposure to the contaminated feed. The exposure of poultry to these toxins can mean the difference between profit and loss in poultry industry (Kaya *et al.*, 1990; Lesson *et al.*, 1995). The world-wide problem of mycotoxicosis is reflected by the fact that over 60 countries have either legislation or proposed

عملية توصيل الشريان بالوريد لإجراء الدهلزة: تجربة شخصية في مستشفى تعليمي بالمملكة العربية السعودية

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الدمام - المملكة العربية السعودية

المخلص :

الهدف : مراجعة لتجربة شخصية في عمل توصيلة شريان بوريد لإجراء الدهلزة في مستشفى تعليمي بشرق المملكةالعربية السعودية.

الطريقة : مراجعة ملفات المرضى واستخرام العمر والجنس والجنسية ونوع التوصيلة والجانب الذي اجريت به وكذلك نتائج العملية خلال ستة أسابيع من اجرائها.

النتائج : اجريت 275 عملية متوالية إلى 257 مريضا من بينهم 154 ذكرا و 103 أناث.

لقد كان بقاء التوصيلة تعمل بالطريقة المرغوبة بعد ستة أسابيع (وقت نضج التوصيلة) بنسبة 93٪ . وكانت نسبة المضاعفات في هذه العملية هي 8.8٪ من المجموعة الكلي، بينما كانت المضاعفات 28٪ حين اجراء التوصيلة في الكوع.

الاستنتاج : عملية برسكيا – سمينو لتوصيل الشريان بالوريد هي الخيار الأفضل لإجراء الغسيل الكلوي (الدهلزة).

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(Table 4). Massive swelling of the arm is also reported with out-flow hypertension [11-12]. Two (8 %) of the anticubital sub-group needed closure of the fistulae for this complication.

Conclusions and recommendations:

Our findings support the previous reports that end-to-side cephalic vein to radial artery fistula is the fistula of the first choice in access creation.

We also believe that the more distal the initial fistula is located the better since this approach spares vessels for future revisions and creation.

Proximal venous hypertension can be a source of future morbidity in these patients.

To decrease the possibility of this complication, we suggest to avoid central venous line for hemodialysis as much as possible.

Making sure of the completion and patency of the palmar arch provide better protection to the hand and fingers.

Acknowledgement:

I would like to express my thanks and appreciation to my colleagues in Nephrology Unit for referring their patients to me for access creation. Without their referrals, I would not be able to report on this group.

Discussion:

The need for vascular access is life long in patients on chronic hemodialysis, and it becomes a limiting factor in their well-being. It is necessary to preserve blood vessels for future revisions and new access formation.

Many factors affect the patency of created AVFs. Some are local such as the size of the fistula, patency of the blood vessel, and pliability of its wall. Loco-regional factors include venous hypertension due to proximal stenosis or obstruction [(7)], and atheroscelrosis of the feeding artery, while systemic factors include hypercoagulable state. Synthetic conduits bear less patency rate, probably due to an over-growth of false intima.

In this group of patients, we addressed a specific issue, namely the use of native vessels on a side with no previous permanent or temporary access creation. We chose the site to be as distal in the extremity as possible, making sure, at the same time, to safe-guard the blood supply to the distal tissue by checking for the completion of the palmar arterial arch, and doing Allen test.

Our patency rate, being above 90 %, matches the better rates reported in the literature. At the same time, most of the complications we encountered were directly related to the fistula site. These complications were thrombosis, bleeding suture line, and hematoma collection. Threatened tissue, as manifested by distal ischemia, pain, and massive swelling, was seen in the anticubital subgroup of our patients.

Brescia-Simino AVF can be created by anastomosing the vein to the radial artery either by side-to-side, end-to-end, or end to side. The first option is associated with hand swelling [(9),] while the second option is associated with higher incidence of distal ischemia, specially if the palmar arch is not complete. End to side anastomosis is the safest [(10)]. Our approach of end-to-side AVF supports these findings. We had no distal ischemia or swelling in this sub-group.

Distal ischemia is also reported in anticubital fistulae [(6)]. We had four (16 %) patients suffered from distal ischemia among 25 fistulae created. Two of them needed closure of the fistulae because of the severity of symptoms, while the other two were treated successfully with fistuloplasty

Over all complication rate = 28 %.

** Created in-anticipation of future need.

We re-operated on 19 fistulae on an emergency basis (Table 3) 14 for acute thrombosis, three for bleeding suture line, and two for evacuation of hematoma. Three other re-operations were to resect aneurysms which developed on the venous side of the suture line in this AVF group. 17 fistulae (3 in the anticipation to dialysis) failed to develop to the degree required for hemodialysis (Table 2)

Table (3)
Complications and Re-exploration seen in AVF (N=250)

Complication	Frequency	% Total fistulae
Thrombosis	14	5.6
Bleeding	3	1.2
Hematoma	2	0.8
Re-operation : Acute	19	7
" " : delayed	3 *	1.2
Over all	22	8.8

* Aneurysmectomy

Of the anticubital AVFs, seven required re-operation (Table 4) five were closed, two for severe distal ischemia, two for massive arm swelling and one for aneurysm at the fistula site. Two other fistulae underwent fistuloplasty for distal ischemia.

Table (4)
Re-operation Anticubital fistulae (N=7 out of total 25)

Complication	Closure (% total anticub. fist.*)	fistuloplasty (%)
Distal ischemia	2 (8)	2 (8)
Swelling	2 (8)	---
Aneurysm	1 (4)	---
Total complication	5 (20)	2 (8)

* anticubital fistulae

Results:

We reviewed the charts of 257 patients (Table 1) Of these 154 were males and 103 females. Their age ranged between 14 and 81 years, (mean 45.3 years.) Over 77 % (200) were Saudi nationals, while the remaining 57 (22.2 %) were from 11 different nationalities. Of the Saudi nationals, 108 were males, and 92 were females.

We created 186 left sided AVFs (Table 2) and 64 right sided ones. Of this group, 17 AVF (10 left sided, and 7 right sided) were created in anticipation of a future need for hemodialysis. This report also includes 25 anticubital AVFs. These 275 fistulae had not been preceded by any other form of ipsilateral fistula creation.

Table (1)
Sex and Nationality of Patients Studied (N=257)

	Male (% of total)	**Female (%)**	**Total (%)**
Total	154 (60)	103 (40)	257 (100)
Saudis	108 (54)	92 (46)	200 (77.8)

Table (2)
Side and Outcome AVF Studied (N=250)

Side of operation	**Imm.* / failed (% failed)**	**In-antic.** / failed (% failed)**	**Total failed (%)**	**Total Operated**
Right	57 / 2 (3.5)	7 / - (0)	2 (1.5)	64
Left	176 / 12 (7)	10 / 3 (30)	15 (8)	186
Total (%)	233 / 14 (6)	17 / 3 (18)	17 (7)	250

* Immediate need.

Beside age, sex, and nationality, data on type of fistulae created and earlier outcome were retrieved and analyzed.

Of these 275 AVF, 250 were between radial artery and cephalic veins, and 25 between the brachial artery and a suitable (mostly cephalic) vein. Seven complications were encountered in the latter group.

Brescia-Cimino AVF became the procedure of choice ever since it was first created in 1966. We used this approach in 250 of the 275 created fistulae. We had 93 % patency rate compared with international rate of 75.5 – 81.3 % [4-6]. The main causes of failure in AVF are the anatomical difficulty of small, sclerosed, or non-patent vein, atherosclerosis of the radial artery, and/ or no completion of the palmar arch leading to distal ischemia. Ipsilateral subclavian vein stenosis and its role in AVF failure [7], or limb swelling [8] add to the difficulties in AVF creation and sustainment.

Patients and methods:

This is a retrospective review of patient-charts. Beside demographic data of age, sex and nationality, data on site and type of fistulae created, date of creation, and outcome within the first six weeks were retrieved. Data were analyzed using SPSS for Windows version 6.

The completion of the palmar arch was assured by doing Allen test. The end of the cephalic vein was anastomosed to the side of the radial artery just proximal to the wrist joint. The non-dominant hand was used unless it was previously used or the vessels were not usable.

The patency rate was calculated at the time of expected maturation of the fistulae, which is six weeks from the date of creation. The fistula was re-explored on an emergency basis if, within the first five days of its creation, the flow was not satisfactory by physical examination and by Doppler ultrasound. It was considered not developed or failed, if, at six weeks from creation, it could not support the desired flow to the dialysis machine.

Acute complications looked for were thrombosis, active bleeding, and hematoma formation. Chronic complications included swelling around the fistula site, distal ischemia and non-usability.

Arterio-Venous Fistulae for Hemodialysis A Personal Experience in a Saudi Arabian Teaching Hospital

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Abstract:

Objective: To review personal experience in creating arterio-venous fistulae (AVF) for hemodialysis in a teaching hospital in Eastern Saudi Arabia.

Methods: Retrospective review of patient-charts extracting age, sex, nationality, type and side of the fistula created, and the outcome within six weeks from creation.

Results: 275 consecutive fistulae were created in 257 patients. 154 were male, and 103 females. Six weeks (maturation time) patency rate was 93 %, and over all complication rate was 8.8 % in the Brescia-Simino fistulae, while it was 28 % in the anticubital variety.

Conclusion: A Brescia-Simino AVF is the first choice when creating a vascular access for hemodialysis.

Introduction:

Chronic renal failure is a major and life threatening disease that taxes national resources. It is especially important in the Kingdom of Saudi Arabia where diabetes mellitus causes renal failure in up to 16-30 % [1-2] of kidney diseased patients.

Diabetes mellitus mal effect on the vascular tree, including that of the upper extremity, is well documented [3]. This includes blood supply to any created AVF and hand.

Accessing the circulation for hemodialysis is a major limiting step, and, is a life long hurdle in the well being of the chronically dialyzed patient. Here, a personal experience of 275 consecutive AVF created in 257 patients is reported.

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