



Service de Coopération  
et d'Action Culturelle -  
SCAC  
Rue n° 13 – Amarat  
P.O. Box 377  
KHARTOUM - Soudan  
Tel : 249 11 47 88 93



University of KORDOFAN  
Faculty of Natural  
Resources and  
Environmental Studies  
P.O. Box 160 –  
ELOBEID - Soudan  
Tel : 249 611 23579

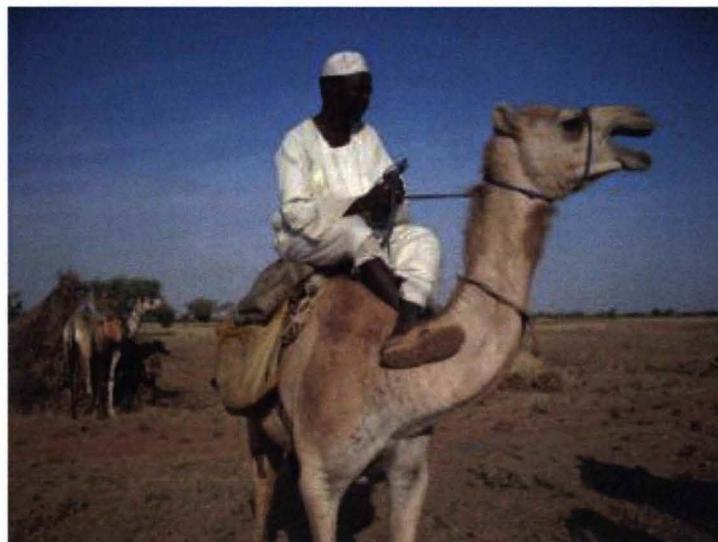


University of KHARTOUM  
P.O. Box: 321,  
KHARTOUM – Sudan  
Tel: 249 777 941 – 779 787

# Rapport de MISSION au SOUDAN

Du 22 février au 3 mars 2010

*Bernard FAYE*



Mars 2010



CIRAD-ES  
Département ENVIRONNEMENTS et  
SOCIETES du CIRAD  
Campus International de Baillarguet  
TA C-DIR / 02  
34398 Montpellier Cedex 5  
FRANCE

**CIRAD-Dist**  
UNITÉ BIBLIOTHÈQUE  
Baillarguet



CIRAD



\*0000105118\*

CIRAD-ES 2010

Tous droits de traduction, de reproduction par tous procédés,  
de diffusion et de cession réservés pour tous pays.

**AUTEUR :** Bernard FAYE

**ACCÈS au DOCUMENT :**

Service Documentation du CIRAD

**ORGANISME AUTEUR :** CIRAD

**ACCÈS à la RÉFÉRENCE du DOCUMENT :**

Libre

**ETUDE FINANCIÉE PAR :**

SCAC Khartoum

**REFERENCE :**

**AU PROFIT DE :** Université de Khartoum

**TITRE :** Rapport de mission au Soudan – 22 février au 3 mars 2010

**TYPE D'APPROCHE DATE et LIEU de PUBLICATION :**

Rapport de mission, mars 2010, Montpellier (France)

**PAYS ou RÉGIONS CONCERNÉS :** SOUDAN

**MOTS-CLEFS :** Soudan, camélidés, Université Kordofan, lait de chameau

**RÉSUMÉ :**

Invité par l'Université de Khartoum à sa Conférence Scientifique Internationale (*Postgraduate studies and scientific research International conference*), j'ai été sollicité comme key-speaker dans la session « recherches agro-vétérinaires » pour présenter mes travaux sur les camélidés, notamment ceux entrepris avec mes collègues de l'Université du Kordofan (une thèse soutenue en 2008 et deux thèses en cours).

Ce séjour a été aussi l'occasion de faire le point sur l'avancement des travaux de thèse d'OMAR ABDELHADI (qualité de la viande cameline) et ADAM ISMAIL MOHAMMED (microbiologie du lait fermenté de chameau).

Enfin, il s'est agi aussi de préparer un atelier prévu de longue date sur les recherches en coopération avec le CIRAD à l'Université d'El-Obeid. Cet atelier (recherches cameline, recherches sur la gomme arabique, agriculture traditionnelle en milieu aride) aura lieu en octobre prochain et plusieurs collègues de l'INRA seront invités à cette occasion. Cette manifestation a déjà reçu le soutien du Service de Coopération de l'Ambassade.



## **SOMMAIRE**

Résumé

Remerciements

Introduction

1 – Avancée des travaux de thèse .....	1
1-1. Omar Abdelhadi.....	1
1-2. Adam Ismail Mohamed .....	2
2 - Lettre d'intention .....	2
3 – Workshop .....	2
4 - Conférence de l'Université de Khartoum .....	3
5 - Projet de Thèse pour Elamin Saad (Nyala University).....	3
6 – Conclusion .....	4

## **ANNEXES**

Annexe 1 – Calendrier et personnalités rencontrées .....	7
Annexe 2 – Dossier de soumission à l'IFS .....	11



## Résumé

Invité par l'Université de Khartoum à sa Conférence Scientifique Internationale (*Postgraduate studies and scientific research International conference*), j'ai été sollicité comme key-speaker dans la session « recherches agro-vétérinaires » pour présenter mes travaux sur les camélidés, notamment ceux entrepris avec mes collègues de l'Université du Kordofan (une thèse soutenue en 2008 et deux thèses en cours).

Ce séjour a été aussi l'occasion de faire le point sur l'avancement des travaux de thèse d'OMAR ABDELHADI (qualité de la viande caméline) et ADAM ISMAIL MOHAMMED (microbiologie du lait fermenté de chameau).

Enfin, il s'est agi aussi de préparer un atelier prévu de longue date sur les recherches en coopération avec le CIRAD à l'Université d'El-Obeid. Cet atelier (recherches camélines, recherches sur la gomme arabique, agriculture traditionnelle en milieu aride) aura lieu en octobre prochain et plusieurs collègues de l'INRA seront invités à cette occasion. Cette manifestation a déjà reçu le soutien du Service de Coopération de l'Ambassade.



## **Remerciements**

Je tiens très sincèrement à remercier mes partenaires soudanais qui, comme à l'accoutumée, se sont beaucoup dépensés pour faciliter mon séjour.

Un grand merci à l'ensemble du Service de Coopération de l'Ambassade et à son Excellence Monsieur l'Ambassadeur pour l'accueil qu'ils m'ont réservé et leur soutien à la coopération avec le CIRAD.



## Introduction

Prévue dans le cadre de la supervision des travaux de thèse dont le CIRAD assure le co-encadrement (thèses enregistrées à l'Université de Khartoum), cette mission devait permettre aussi de participer à la Conférence Scientifique Internationale organisée par l'Université de Khartoum, avec l'appui de l'Ambassade de France, et pour laquelle les collègues du CIRAD et des autres instituts de recherche français impliqués dans la coopération avec le Soudan étaient également invités. Pour l'état des lieux de cette coopération, on se rapportera aux rapports précédents<sup>1</sup>.

### 1 - Avancée des travaux de thèse

#### 1-1. Omar Abdelhadi

Quatre points sont abordés.

- (1) L'enquête zootechnique est terminée et les données sont analysées. Un article a été écrit (prévu dans *Journal of Camel Practice and Research*), mais demande des révisions. Ces révisions ont été faites lors de mon séjour.
- (2) L'enquête en abattoir a permis de déterminer l'effet saisonnier sur la composition et la qualité de la viande de chameau (analyses réalisées à l'INRA). Un autre article a été écrit et revu par les collègues de l'INRA et moi-même<sup>2</sup>. Cet article va être soumis à *Meat Sciences*. Cette étape est importante car cette revue est bien cotée (bon facteur d'impact) et cela permettrait de positionner Omar dans la communauté scientifique internationale travaillant sur ce sujet.
- (3) Une autre enquête en abattoir sur des animaux adultes pour étudier l'effet du stockage au froid sur la qualité de la viande et ses caractéristiques. Les données sont traitées et doivent être publiées. L'article reste à écrire. La revue *Meat Sciences* est également visée.
- (4) Une partie de l'échantillon 2 a été analysée pour la composition en acides gras et en minéraux et pourrait faire l'objet d'un autre article (évaluation de l'effet saison). Sur ces animaux nous avons aussi les mesures barymétriques et la composition en acides gras de l'alimentation.

A cela s'ajoute l'essai d'engraissement (essai d'alimentation) dans 3 systèmes d'élevage (extensif à intensif), puis l'analyse de la qualité de la viande après la fin de l'expérimentation.

---

<sup>1</sup>FAYE B., 2006. *Mission d'appui à la thèse de Mr Sallam A. Bakheit (Soudan)* : « Camel performance under semi-intensive system ». Rapport de mission CIRAD-EMVT n°2006-03, Montpellier, 37 p.  
FAYE B., 2007. *Mission d'appui aux thèses de Mrs Sallam A. Bakheit et Omar Abdelhahi (Soudan). Productions camélines au Soudan*. Rapport de mission CIRAD-ES du 21/02 au 2/03/07, Montpellier, 22 p.

FAYE B., 2008. *Productions camélines au Soudan. Mission d'appui aux thèses de Mrs Omar Abdelhahi et Ismail Adam Mohamed (Université du Kordofan)*. Rapport de mission CIRAD-ES, Montpellier, 16 p

Depommier D., Faye B., Domaingue R., 2008. *Rapport d'une mission CIRAD aux universités de Gezira et Kordofan et à Kenana Sugar Company, Soudan*. Du 18 au 24 novembre 2007, Rapport CIRAD, Montpellier, 41 p.

<sup>2</sup> Abdelhadi O. Babiker S.A., Jailler R., Picard B., Jurie C., Hocquette J.F., Faye B., *Effect of season on muscle characteristics of desert camel (*Camelus dromedarius*)*

Il y aurait 7 dromadaires par groupe (n=3), engrangés pendant 70 jours. Ces analyses seront l'objet du troisième séjour en France. La difficulté demeure le coût des analyses. Enfin, une nouvelle soumission à l'IFS est essayée après l'échec de l'an dernier en tenant compte des remarques des referees. Il s'agit dans ce nouveau texte de se focaliser sur 3 aspects uniquement :

- (1) étude des pratiques de finition sur les caractéristiques des carcasses,
- (2) impact des conditions d'abattage sur la qualité de la viande,
- (3) essai de classification des carcasses. On trouvera le projet soumis en annexe.

## **1-2. Adam Ismail Mohamed**

Au cours de son dernier séjour à Montpellier, un certain nombre d'analyses ont été réalisées. La tendance semble plus de multiplier les analyses que les échantillons pour des problèmes de coût. Il a donc été discuté de la pertinence du protocole d'analyse. Dix échantillons de Khartoum (analyses réalisées au Soudan). Seize échantillons de Kordofan (analyses en France) : Composition chimique, composition minérale et bactériologique. L'objectif est de voir les relations avec les pratiques de préparation du gariss. Vu le nombre restreint d'échantillons, il faudra limiter le nombre de variables explicatives (temps de préparation du gariss, type d'additifs, type de système d'élevage, zone d'origine).

Dans un premier temps, il est envisagé de faire une analyse graphique des résultats descriptifs afin de définir les modalités des facteurs de variation. Le programme d'analyses à réaliser à Montpellier a été défini et les contacts avec le laboratoire de microbiologie de l'UMR Qualisud ont été pris pour préparer sa venue. La durée du séjour pourrait se dérouler sur 4 mois minimum. L'objectif du séjour est d'identifier les souches de bactéries lactiques susceptibles de servir de starter pour des produits innovants pouvant être mis sur le marché urbain. Cela nécessite un important travail d'isolement et d'identification des souches bactériennes par les méthodes les plus modernes (PCR, API système,...). Adam est déjà coutumier de ces analyses, mais elles prennent du temps. Enfin, un projet de publication à partir de la thèse vétérinaire du Lucie Blanchard venue en stage en 2009 est en cours de réalisation.

## **2 - Lettre d'intention**

La copie a été envoyée à Denis DEPOMMIER et quelques remarques ont été faites. Après prise en compte des remarques, et réaménagement au cours de mon séjour, cette lettre doit être envoyée par le Vice-Chancellor de l'Université du Kordofan à Gérard MATHERON (Directeur du CIRAD) sous-couvert de M. Eric PINON (SCAC- Khartoum). Cette lettre précise le contour de la coopération à mettre en place. Elle institutionnalise surtout les contacts existants.

## **3 - Workshop**

Ce workshop, sans cesse repoussé, avait pour objectif de définir la programmation scientifique pour les différents champs de la coopération avec le CIRAD. Après discussion sur les dates et le contenu, il est suggéré de faire ce workshop fin octobre. Il est proposé de

se recentrer sur la programmation scientifique de la coopération et éviter les présentations par trop académiques, mais en regroupant les différents ateliers prévus en un seul (voir encadré).

*Programme (3 jours) :26-27-28 Octobre*

***Workshop on the sustainable management of agroecosystem in low rainfall rangeland of Kordofan***

- Plenary session with key speakers (one from France, one from Sudan) in 3 main fields:
  - Camel production
  - Arabic gum
  - Traditional agriculture
- Specific sessions for each topic
- Round table for each field
- Plenary session on recommendation and research policy
- Field trip

La première annonce officielle sera faite le 1er avril. Les thèmes concernant les camélidés ont été discutés et la liste des key-speakers est en cours de mise en place.

Les présentations devront être prêtes fin juillet pour les *proceedings* qui seront remis le jour du workshop. La diffusion au CIRAD, INRA, IRD sera assurée par Denis DEPOMMIER, Directeur régional.

#### **4 - Conférence de l'Université de Khartoum**

Organisée par l'Université de Khartoum (Dr ABDEL-AZZIZ), cette Conférence Scientifique Internationale regroupait plusieurs sessions (sciences médicales, sciences humaines, sciences agrovétérinaires), si bien qu'elle regroupait des thématiques extrêmement diverses rendant difficiles les échanges sur des centres d'intérêt aussi variés. Du reste, c'est pour cette raison que nombre d'étrangers ne sont pas venus. Il n'y avait que 7 représentants non soudanais (Italie, Suède, Grande-Bretagne, Corée, Egypte et deux français en m'incluant).

Toutefois, comme à l'habitude, c'est dans les couloirs de la conférence que l'essentiel des discussions intéressantes a eu lieu. En particulier, j'ai pu avoir une réunion de travail avec les responsables de la recherche cameline de l'Université de Khartoum ainsi qu'avec la toute nouvelle *association of camel research* au Soudan (sous la tutelle de l'ISOCARD). Invité par l'Université comme key speaker, j'ai proposé une communication sur les nouveaux challenges de la recherche concernant les camélidés. L'an prochain, la conférence devrait se focaliser sur les recherches médicales.

#### **5 - Projet de Thèse pour Elamin SAAD (Nyala University)**

Cette demande, soutenue par la Coopération Française (notamment pour soutenir la coopération avec le Darfour venant de signer les accords de paix), consistait une première évaluation de la proposition d'un étudiant en master (Mr Elamin SAAD). Celle-ci était

essentiellement basée sur l'apprentissage d'une technique (microscope électronique) pour étudier l'ultrastructure cellulaire de la glande thyroïde de la chèvre, thème très académique et sans intérêt opérationnel évident. Après discussion, il est suggéré à l'impétrant de revoir sa proposition en intégrant des aspects physiologiques (physiologie de la reproduction) et zootechnique (effet de l'alimentation) sur l'histologie fine de la glande thyroïde et sur son fonctionnement. Une nouvelle proposition est attendue d'ici un mois.

## 6 - Conclusion

Depuis plusieurs années, nos partenaires souhaitent une officialisation de la coopération par la signature d'une convention-cadre qu'appuie l'Ambassade de France. Après plusieurs allers-retours, il serait temps que cette signature puisse avoir lieu et qu'une enveloppe globale soit affectée à cette coopération par le SCAC, ce qui en faciliterait la gestion globale par le CIRAD.

Par ailleurs, dans ce contexte, la coopération sur les recherches camélines prend une place importante, les sollicitations étant largement en augmentation.

## **ANNEXES**

**Annexe 1 – Calendrier et personnalités rencontrées**

**Annexe 2 – Dossier de soumission à l'IFS**

CIRAD-Dist  
UNITÉ BIBLIOTHÈQUE  
Baillarguet



## **ANNEXE 1**

**Calendrier et personnalités rencontrées**



## **Calendrier et personnalités rencontrées**

### **Mardi 23 février**

- Départ de Montpellier via Marseille

### **Mercredi 24 février**

- Départ pour Khartoum via Amsterdam
  - Accueil à Khartoum par OMAR ABDELHADI
  - Transfert à l'hôtel

### **Jeudi 25 février**

- Entretien avec M. PINON (SCAC Khartoum)
- Règlement des problèmes administratifs (enregistrement immigration)

### **Vendredi 26 février**

- Départ pour El-Obeid en autobus avec OMAR ABDELHADI
  - Entretiens avec SALLAM BAKHEIT et ADAM ISMAIL

### **Samedi 27 février**

- Entretien avec ABDALLAH ABDALLAH, Doyen pour les affaires scientifiques et les membres du Comité d'organisation du Workshop d'octobre
- Visite de l'installation expérimentale de SALLAM BAKHEIT
- Discussion sur l'avancée des travaux de thèse D'ADAM ISMAIL et d'OMAR ABDELHADI

### **Dimanche 28 février**

- Retour sur Khartoum en bus
  - Accueil par le Pr. Y. ELAMIN, Professeur de français à l'Université de Khartoum
  - Entretien avec M. ABDEL-MEGUID DERBALA (Pr. de parasitologie au NRC du Caire (Egypte))
  - Réception par le Vice-Chancellor de l'Université de Khartoum

### **Lundi 1er mars**

- Entretien avec MM. PINON et MALARA au SCAC
- Entretien avec M. ELAMIN SAAD, Etudiant de l'Université de Nyala (Darfour) pour son projet de PhD
- Participation à la Conférence de l'Université de Khartoum
- Finalisation du projet IFS avec OMAR ABDELHADI

### **Mardi 2 mars**

- Participation à la conférence
- Présentation d'une communication « *the new challenges of the camel sciences* »

- Réunion avec les chercheurs camélologues de Khartoum (Pr. ALI ELAMIN, Pr. ELSHEIKH, Pr. AWAD AHMED)
- Session de clôture
- Dîner chez S.E M. PATRICK NICOLOSO, Ambassadeur de France

**Mercredi 3 mars**

- Départ pour Marseille via Amsterdam

## **ANNEXE 2**

**Dossier de soumission à l'IFS**



# Dossier de soumission à l'IFS

IFS code 1.5e



INTERNATIONAL  
FOUNDATION FOR  
SCIENCE

## APPLICATION FOR FIRST IFS RESEARCH GRANT

Fill in the shaded fields – use the TAB key on the keyboard or your mouse to move between fields.  
Read carefully the Guidelines for general instructions and advice pertaining to specific questions.  
This form may not be modified from its original format.

### 1. APPLICANT

Your title: Mr Your surname: ABDELHADI  
Sex: Male Your given name(s): OMER  
Your name as it appears on your publications: O. M. A. ABOELHADI  
Date of birth: day:26 month:10 year:1974 Nationality: SUDANESE  
Your most recent academic degree (eg PhD, MA, MSc, etc): M.Sc

### 2. RESEARCH PROJECT

Title of your project: Assessment of meat quality of camel calves carcasses in Sudan

Short summary of project:

In Sudan, the camel meat consumption is an important source of animal protein for human population in remote areas of the country. The present project will focus on the assessment of camel meat quality for human consumption. It will include four specific objectives: (i) Study of the relationship between the gross farming condition, animal characteristics (including body condition score and body measurements) and slaughtering conditions on the quality of carcass, (ii) Analysis of meat quality (physical & chemical attributes and sensory evaluation) of camel meat, (iii) Proposal of score for classification of camel carcasses, (iv) Investigation of consumer preferences to different parts of the carcasses and quality. To achieve these objectives the work plan will include 8 steps: (i) Retrospective questionnaire on farming condition and animal characteristics for camels before slaughter, (ii) Live animal measurements including body condition score, (iii) Investigation of slaughter conditions, (iv) Carcass measurements, (v) Collection of 45 meat samples from 3 different abattoirs in different seasons, (vi) Physical and chemical analysis of meat samples from longissimus dorsi muscle, (vii) Classification score of the carcasses, (viii) Investigation of the consumer preferences to different parts of camel carcasses in the market. The project will include three different slaughter houses in different regions and approximatively 400 to 500 camels. Meat samples will be then analysed for: proximate analysis, chemical analysis, fatty acids profile, protein fractionation, mineral and vitamins. The main expected result is to get classification scoring of camel carcasses. The main part of the budget is due to the cost of analysis.

Estimated budget of your project: USD 12000

Select 3 - 5 key words describing your project:	camel	meat quality	slaughter
	meat composition	carcass	

### 3. SIGNATURES

You cannot sign this page on your computer. Print this first page. The Applicant and the Head of Institution must sign it. It should be stamped by the institution and sent (THIS PAGE ONLY) by airmail to IFS. When the form is completed, email the entire form to IFS at [applications@ifs.se](mailto:applications@ifs.se).

Applicant's signature:

Date:

I, the Head of this Institution, declare:

Institution's official stamp:

- that the above named Applicant is attached to this institution;
- that the institution supports this Application and will make its resources available to the Applicant for the duration of the project if he/she receives an IFS grant;
- that I have read this Application in its entirety.

Head of Institution's signature:

Date:

Name, title and official position: Maakeen A. Maakeen, Professor and Dean of Faculty of Natural Resources & Environmental Studies, University of kordofan.

(please type)

#### 4. CONTACT INFORMATION

##### 4.1 The Institution that will administer your IFS grant:

Full name and address: <i>(include Department, Faculty or Institution, University, PO Box or street address, and City, if relevant)</i>	UNIVERSITY OF KORDOFAN, FACULTY OF NATURAL RESOURCES & ENVIRONMENTAL STUDIES, DEPT. OF ANIMAL PRODUCTION P.O. BOX 160, NORTH KORDOFAN STATE, ELOBEIDD, SUDAN.
Country:	SUDAN
Telephone numbers at the Institution: <i>(include area code but not country code)</i>	Your direct no: +249912255401 Institution's general no: +249611823579 Fax no: +249611832877
Your e-mail address at this Institution:	omerabdelhadi @uni-kordofan.com

##### 4.2 If you will be carrying out your research at an Institution or location different from the one provided in 4.1, please provide the full address for your research location in the space below:

Full address: <i>(include Department, Faculty or Institution, University, PO Box or street address, and City, if relevant)</i>	University of Khartoum, Institute of Promoting Animal Exports. P. O. Box: 321, Khartoum, Shammbat.
Country:	Sudan
Is this your preferred mailing address? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
Telephone numbers at this address: <i>(include area code but not country code)</i>	Your direct no: +249912255401 Institution's general no: +249185329660 Fax no:
Your e-mail address at this place:	Abusin911@Yahoo.com
The purpose of your stay here:	Provide of equipments & chemicals .
Until what date is this address valid:	During the year 2008\2009
Further remarks:	

#### 5. YOUR LANGUAGE SKILLS

	Read		Speak		Write	
	Easily	Not easily	Easily	Not easily	Easily	Not easily
English:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
French:	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Other: Arabic	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Other:	<input type="checkbox"/>					

## 6. YOUR EDUCATION

### 6.1 Major scientific education and academic degrees

Month/Year from	Month/Year to	Names and addresses of educational establishments	Choose degree obtained for each entry
2007	2010	University of Khartoum, faculty of animal production, Khartoum, Sudan.  Name of your Supervisor: Prof. Salih Ahmed Babikker, Sudan & Prof. Bernard Faye, France	English degree: Doctor of Philosophy (PhD) French degree: ----- Spanish degree: ----- Specialisation: meat production Fellowship / study grant from: Government of Sudan
2000	2002	University of Khartoum, faculty of animal production, Khartoum, Sudan.  Name of your Supervisor: Prof. Salih Ahmed Babikker, Sudan.	English degree: Master of Science (MSc) French degree: ----- Spanish degree: ----- Specialisation: Animal production Fellowship / study grant from: Government of Sudan
1992	1997	University of Kordofan, Faculty of Natural Resources & Environmental studies, Ellobied, Sudan.  Name of your Supervisor: Dr. Ali Mahmoud Shammat, Sudan.	English degree: Bachelor of Science (BSc) French degree: ----- Spanish degree: ----- Specialisation: Animal Science Fellowship / study grant from: Private

### 6.2 Other degree not equivalent to any of above

		Degree name:  Specialisation: Fellowship / study grant from:
Name of your Supervisor:		

### 6.3 Other studies and training courses

from	to	Subject	Place
Nov.	Dec.	Course design & Teaching Techniques	G.C.S & UN mission in Sudan, 2007.
Nov.		Meat analysis	INRA, France, 2006.
Oct.	Nov.	Camel Research	CIRAD, EMVT, Montpellier-France, 2006
May	Jul.	Experimental design and statistical analysis	Animal Research Center, Khartoum, Sudan. 2005

## 7. EMPLOYMENT

### 7.1 Your present position

Employer:		University of Kordofan	
Position:		Assistant professor,	
Starting Date:		2002	Permanent <input checked="" type="checkbox"/> Temporary <input type="checkbox"/>
No. of staff supervised by you:		Researchers: 1	
		Graduate students: 3	
		Technicians: 2	
Research areas and responsibilities:		<ul style="list-style-type: none"> <li>- Animal production( meat production) in cattle and camels.</li> <li>- Co-supervisor of postgraduate students - Lecturing (post and under graduate students).</li> <li>- Supervision of dissertation for under graduate students.</li> </ul>	
Name of present scientific supervisor:		Prof. Salih Ahmed Babiker, University of Khartoum, Sudan.	
In case of approval of IFS grant, how would you distribute your time:		Research %: 70	
		Teaching %: 30	
		Administration %: 0	

### 7.2 Your previous positions

Month / Year from	to	Your position and the address of your employer	Research areas and other responsibilities
1998	1999	Teaching Assistant, Dept. of animal production, University of Kordofan, Sudan.	Animal production Meat production.
2005	2006	Registrar of Graduate Studies & Scientific Research, University of Kordofan.	Financing & Following Research activities.
2007	2009	Registered for Phd, University of Khartoum, Sudan. 2002- up to date : Lecturing in the Dept. of animal production, University of Kordofan, Sudan..	Meat Production & Meat Science

## **8. YOUR RESEARCH WORK TO DATE**

### **8.1 Your publications**

- 1- Husbandry practices of camel herders in Kababish home land - north Kordofan state, Sudan. (Submitted to ISOCARD international conference in camels, Tunisia 2009).
- 2- Estimation of carcass weights of western Baggara cattle using carcass measurements. ( Accepted in Sudan Journal of Animal Production May, Jun. 2008).
- 3- Prediction of live weight of Baggara cattle using live animal measurements under conditions of Sudan. (Accepted in Sudan journal of animal production, Aug. 2008).
4. Supervisor of Bsc. dissertation on: Camel meat products, Dept. of Animal Production, University of Kordofan, Sudan, Dec. 2004.
- 5- Supervisor of Bsc. dissertation: Tenderization of camel meat using different periods of storage , Dept of Animal Production, University of Kordofan, Sudan, Nov.2005.
- 6-Supervisor of Bsc. dissertation: Feed lot performance and carcass characteristics of Baggara cattle, Dept. of Animal Production, University of Kordofan, Oct. 2006.

### **8.2 Describe your results and experience related to the proposed research project**

- 1- We studied quality attributes of camel meat compared to beef and investigated the use of camel meat in processing of meat products mainly burger and sausages. The results showed high moisture content, water holding capacity and high percentage of protein content were found in camel meat. Moderate tenderness was reported by the panelists which was attributed to high content of fibers specially in old age camels. Juiciness was good but the study recommended addition of 10-15% of fat to camel meat to increase camel meat acceptability. Young camel calves are comparable to beef in meat texture.
- 2- An other study in Tenderization of camel meat by using different periods of storage. The results showed that aging could be one of the best methods which can improve tenderness of camel meat. It was found that aging of camel meat for two and three weeks gave better results of tenderness compared with meat samples kept for one week. No significant differences was found between the storage periods (2 and 3 weeks), but it was highly significant for one week ( $p<0.05$ ). Also it was found that most of the camels are slaughtered at the end of their production life. This contributed negatively to meat quality which became fibrous and tough during eating as a result of this consumer acceptability will be reduced.
- 3- The study of the effect of season on muscle characteristics of desert camel (*Camelus dromedarius*) has been achieved. Thirty 2-3 year-old camels fattened by local farmers in Sudan were used for this study. Ten camels were slaughtered according to each season of the year (winter, summer and autumn) to examine muscle characteristics. Chemical composition, pH, color and metabolic and contractile characteristics were also investigated. Samples of Longissimus thoracis (LT) between the 5th to 8th rib were randomly selected from the right side of the carcasses. Season influenced significantly muscle crude protein and ash ( $P<0.001$ ) and no significant differences were found between seasons for dry matter and intramuscular fat.
- 5- Effect of cold storage on meat quality characteristics has been studied.  
Husbandry practice and relationship with camel production

### **8.3 Describe ongoing work at your Institution related to the research project**

#### **1- The use of camel meat in meat products as alternative of beef in Kordofan state- Sudan.**

Beef prices are expensive in the local market in Sudan even for old ages as well as meat products. Camel meat is cheaper than beef (14 versus 9 pounds in average for beef and camels, respectively). It is preferred by a large number of people in the country specially in towns in the western regions Darfur and Kordofan and also the people who live in rural areas. The study is an attempt to make use of this benefit to reduce the cost of meat products which prices rapidly. The study used pure camel meat for production of meat products (sausage and burger) and also the addition of camel meat to beef and mix them together by 25% and 50% and 75% to produce the same meat products and compare their acceptability by the consumers. The study revealed that there was no differences between beef and camel meat in terms of juiciness, texture and water holding capacity. Pannal test showed great acceptability to the camel meat and no differences were observed between the mixture of camel meat and beef compared to pure camel and beef. Further studies are needed to assess the quality of different camel meat products.

#### **2- Phenotypic characteristics of camel types in Sudan.**

This aims to study the phenotypic characteristics of different camel types in North Kordofan state, Sudan. As there are many tribes raising camels in different farming conditions. The study aimed to make wide survey to study the phenotypic characteristics of different camel types in 4 major areas in north Kordofan state as well as the genotypic characteristics as second phase to study the genotypic characteristics of camel types in Sudan.

### **8.4 Research partners and/or relevant contacts already established by you; give names, full addresses, e-mail, field of specialisation, and (if applicable) the specific role of partner researchers in this IFS project**

1- Prof. Salih Ahmed Babiker, Institute of Promoting Animal exports, University of Kartoum, Sudan. Specialist in Meat production and meat Science. Role: Advisor, Statistical analysis and tabulation of results, provision of some laboratory equipments. Tel: +249912148394.

2- Bernard Faye, CIRAD- ES, International campus of Baillarguet, TA/C-Dir 34398, Montpellier, France. email: bernard.faye@cirad.fr, Specialist in camel research. Role: External supervisor, interpreting of results and bibliography research.

3- Jean-François Hocquette, INRA, Meat sciences unit, 63122, Saint-Genest Champanelle, France. email: Hocquet@clermont.inra.fr. Specialist in meat science. Role: Chemical analysis of meat samples.

### **8.5 Additional contacts you want to establish; give names, full addresses and field of specialisation**

1- The regional institute of meat hygiene, grading and processing of meat. Dr. Fatima Mohamed . Field of specialization: Meat grading and processing. Khartoum north. P O Box: 315.

2- Agricultural Research Center(ARC), Dept. Animal production, north Kordofan state, Sudan. Prof. Faysal Alhaj, specialist of animal production. Ellobied P O Box: 152, Sudan.

3- Kadim, Oman

## **9 PROPOSED RESEARCH PROJECT**

**9.1 Give the background to the research. Define the problem that the proposal seeks to address, thus justifying the research. Identify the stakeholders that are relevant to this problem.**

Ministry of Animal Resources, Sudan reported that camel population was 4.4 million heads in the year 2008 that represents the second camel population in the world after Somalia. A total of (116,184) heads were exported in the same year with total value of 19 million Dollars (\*Central Bank of Sudan, 2006). It was observed that the local consumption of camel meat increased (from 30,000 to 45,000 tons) from 2000 to 2008 (FAOstat, 2009). Camels are raised in arid and semi-arid areas and totally depend on the pasture during that it covers large areas seeking water and food which is fluctuating from year to year. It takes on average of 5-6 years to reach the mature weight with low quality meat in terms of quality attributes. The quality of meat produced by younger camels is comparable to beef in texture, but chemically, camel meat is superior in moisture and protein content than beef and contains low fat percentage. However, the variability in meat quality could be high and is mainly under two determinants: the feeding conditions before slaughtering and the slaughtering and dressing conditions. In Sudan, 80% of the slaughtered camels are fattened in finishing feed lot 2-3 months before slaughtering by the camel traders, using 4 to 5 types of diet. Elsewhere, as the slaughtering facilities are not fairly available in Sudan, our study will be focused on the impact of feeding conditions of finishing animals and of slaughtering conditions on the characteristics of carcass and quality of the camel meat. There is an important demand for camel meat in northern part of Sudan, both for self-consumption and for urban market. Sudan export also camel for meat production mainly to Egypt and gulf countries. However, there is a gap between the camel herders know-how and consumer's demand especially in urban area. Potential of camels as meat producers, as well as their performance under improved conditions received little attention. The link between feeding conditions during finishing time and carcass quality was not studied in Sudan. The question of adequation of camel meat quality expected by consumers and conditions to get a high quality product is still poorly documented, especially in Sudan.

**9.2 Give an up-to-date summary of scholarly knowledge in the field of the project**

Production and reproduction performance in camel herds showed significant variation with varying levels of herding experience and veterinary services. The performance can be enhanced with more experience and services using traditional management practices (1). Average live and carcass weight for both males and females were (465.83 and 335.68) and (252.27 and 170.01) kg, respectively. Males were considered heavier ( $p<0.05$ ) than females (2). Under open range conditions live weight increase of 1 kg/day has been reported. Camels fed on a high energy diet gained 150 kg body weight in 6 months. Well-fed young camels under intensive conditions have gained 0.58 kg/day (3). The nutritional status of domestic animals could be assessed by the observation of body condition score. In camel, the hump is the most important fat storage place accessible to external observation (4). The hump length and the height were good indicators of the carcass weight ( $r= 0.73$  and  $r = 0.78$  respectively) and of the live weight ( $r = 0.54$  and  $r = 0.53$  respectively). Neck perimeter and thigh perimeter were good predictors of the camel carcass weight. The hump represented 80% of the fat stored while the fat around kidney and mesentery represented 15 and 5% respectively (5). Dressing percentage of camel carcasses values from 55 to 70%. Camel lean meat contains 78% water, 19% protein, 3% fat and 1.2% ash. Camel carcass contains 57% muscle, 26% bone and 17% fat with fore halves significantly heavier than the hind halves. The amino acids and mineral contents of camel meat are higher than beef, due to intramuscular fat (6). The percentage of protein decreased and that of fat increased with the increasing of camel age. Muscles of younger camels had significant ( $p<0.05$ ) lower shear force value, ultimate pH and higher sarcomere length, cooking loss fragmentation index and lightness colour (7). Semitendinosus camel muscle had significantly higher myofibril degradation values compared to that in beef which was supported by a difference in troponin-T degradation and appearance of a 30 kDa band. Post-mortem pH decline of camel meat was significantly slower than that of beef (8).  
(see kadim, 2009 review)

**9.3 List of publications/ literature quoted in section 9.2**

Very few information are available in camel meat in international journals. I can mention at least the following papers:

- (1): Megersa, B., Regassa, A., Kumsa, B. and Abunna, F. (2008). Performance of camels (*Camelus dromaderius*) kept by pastoralists with different degree of experience in camel keeping in Borana, Southern Ethiopia.
- (2): Kurtu, M. Y. (2004). An Assessment of productivity for Meat and the Carcass Yield of Camels (*Camelus dromedaries*) and of the consumption of camel Meat in the Eastern Region of Ethiopia. *Trop. Anim. Health and Production*, 36: 65 – 76.1;
- (3): Faye, B., Bengoumi, M., Messad, S., Chilliard, Y., (2001). Fat storage and adipocyte patterns in camel: a tool for management of reproduction. *Advances in Reproduction*, 5, issue 3, 10c
- (5): Kamili, A., Bengoumi, M., Faye, B., (2006). Assessment of body condition and body composition in camel by barymetrimeasurements. *J. Camel Pract. Res.*, 13(1), 67-72.
- (6): Kadim, I.T., Mahgoub, O. And Purchas, R.W. (2008). A review of the growth, and of the carcass and meat quality characteristics of the one - humped camel (*Camelus dromedaries*). *Meat Science*, 80: 555 – 569.
- (7) :Kadim, I.T; Mahgoub, O., Al-Marzoogi, W., Al-Zadjali, S., Annamalai, K. And Mansour, M.H. (2006). Effect of age on composition and quality of muscle Longissimus thoracis of the Omani Arabian camel (*Camelus dromedaries*). *Meat science*, 73: 619 – 625.
- (8): Nafiseh, S., Mahdi, K., Javad, K. And Mohammed, F. (2008). Comparison of fresh beef and camel meat proteolysis during cold storage. *J. Meat Science*, 80 (3): 892 – 895.
- 9) Terliouw, et al., 2007). impact des conditions de pré-abattage sur le stress et le bien-être des animaux d'élevage. INRA Prod. Anim, 20, 93-100.

Kadim, 2009

**9.4 State the objectives of the project**

The overall objective is to assess carcass characteristics and quality of camel meat proposed to consumers in Sudan. The specific objectives are:

- 1- Study of the relationship between the type finishing of camels by traders, animal characteristics (including body condition score and body measurements) and slaughtering conditions on the characteristics of carcasses.
- 2- Impact of slaughtering conditions on the quality and chemical composition of camel meat.
- 3- Proposal of score for classification of camel carcasses.

**9.5 State your scientific hypothesis/research question**

There is an effect of the finishing, and of slaughtering conditions on the characteristics of carcasses and meat quality. The questions are: 1- What is the relationship between type of finishing and carcass quality? 2- What is the impact of slaughtering conditions on meat quality? 3- What are the convenient parameters to classify camel carcasses?

**9.6 State the expected outputs of the project**

- 1.1 Recommendation for an adequate finishing method.
- 1.2 Variability of carcass quality according to finishing conditions.
- 2.1 Description of the types of slaughtering conditions of camels in Sudan.
- 2.2 Recommendation for convenient slaughtering of camels in relationship with meat quality expected.
- 2.3 Variability of camel meat quality according to the slaughtering conditions.
3. Carcass classification scoring.

**9.7 State the relevance of the project in relation to local and regional environmental and socio-economic conditions**

- 1- The study will compare and integrate the local practice of finishing by traders with the scientific experience which will be of relevant to camel meat sector (traders, butchers and consumers).
- 2- Improvement of camel meat quality will contribute positively to promotion of camel farming and to the market integration of the camel farmers in Sudan.
- 3- Improvement of camel meat will also promote camel production for local and regional markets.

**9.8 Research design and data analysis**

Grantees with projects that primarily produce data for statistical analysis are strongly advised to contact an expert in statistical analysis during the planning stage of the research project in order to make sure that the design of the project allows for appropriate analysis.

Have you contacted  
an expert in  
statistical analysis?  
 Yes  
 No  
 Not applicable

If Yes, Name and Institution: Samir Messad, CIRAD-ES, France.

**9.9 Give reference to relevant literature from which you take your research methodology, statistical methods and research or experimental design**

- 1- Statistical Analysis System Institute (SAS), 1995. User's Guide: Statistics. Version 6 ed., SAS Institute, Cary, NC.
- 2- Rao, C.R (1995). Hand Book of Statistics. In: Design and Analysis of Experiments. Volume (13) : 1-1229.
- 2- Ott J. (1992). Methods of linkage analysis. In: Analysis of Human Genetics Linkage. Revised edition. The Johns Hopkins University Press, Baltimore, MD.

**9.10 Which methods will you use to analyse the information that you gather? Refer also to any software you will be using.**

ANOVA (General linear model) in order to compare the groups of camels from different feedlots in the study on finishing (variables to be explained will be carcass measurements). Used also to compare the slaughterhouses, variables to be explained being the quantitative parameters of meat quality. Chi square test will be used for the qualitative parameters. Spearman correlation coefficient between quantitative variables and rank of body condition score and class of carcasses. Multivariate analysis to identify types of carcasses (cluster analysis). SPSS software and R (for multivariate analysis)

### **9.11 Your research plan**

Provide sufficiently detailed descriptions of your methodologies to convince the reader that you have the necessary expertise to do the research. Do not simply make a list of activities.

The work plan will be organised to understand what happen before, during and after slaughtering of camels. Before slaughtering, it is important to know what happen during fattening process (type of diet, season of fattening, duration of finishing). It is important also to assess the animal characteristics expected to meat production. At slaughtering, it is important to know the condition for preparation, killing, remove of skin and internal organs. After slaughtering it is important to know cutting and storage of carcasses then to classify the carcasses. So the work plan will include 7 main steps:

- 1- Survey on finishing of camel before slaughtering. The data collected in feed-lot managed by the traders will include individual data (origin of the animals, phenotype, sex, age) and collective data (type of the 4-5 expected different diets used during fattening by traders, fattening season, duration of finishing). A first classification will be implemented in order to identify the main types of finishing. The survey will be applied among traders supplying the 3 main slaughter houses of the northern part of Sudan (Khartoum, Tambol, Elobeid) which have high difference in origin of animals.
  - 2- Live animal measurements will be taken in ante-mortem observation to estimate the live weights of the animals as well as to compare the differences in body conformation at the end of the finishing (2-3 months duration). The body weight will be estimated with the following measurements: Heart girth, heart girth around the hump, neck circumference, hump height, hump circumference and thigh circumference. Equation for estimating camels live weight is still used but not for Sudanese camel breeds. The body conformation will be appreciated both by the body measurements (BM) and body condition score (BCS) according to the score proposed by Faye et. al, (2002).
  - 3- Carcass measurements after slaughtering (the same animals than step 2) will be achieved and will include: carcass weight, meat color, fat color, kidney fat, muscle pH, hump measurement. The statistical analysis will compare the characteristics of the carcass according to the type of finishing (including a group of camels without finishing if any), and the link between carcass characteristics and live animal measurements will be explored by regression methods.
  - 4- Investigation of slaughtering conditions both at slaughter house level (type of slaughter house and equipments of the slaughtering place) and at the slaughtered animal level (delay of animals before slaughtering the animals, duration of the slaughter process, the condition of the skin and internal organs removal). The questionnaire will be applied according to the number of slaughtered animals, i.e., between 1500 and 2000 camels per year in the 3 slaughterhouses (this number is considered as widely sufficient for further statistical analysis). In addition of that, cutting process, condition of carcass at storage and transport will be reported. It will include temperature of storage, duration of the storage and type of transport. The 3 slaughterhouses are chosen because they are the most important camel slaughtering place and the slaughtering conditions are quite different.
  - 5- Total of 45 meat samples from the 3 different abattoirs (different in slaughtering condition and animal origin and finishing practices) will be taken, i.e 15 samples for each slaughter house. In order to discard the known factors of variation as the season (Abdelhadi et al., 2010), the age and sex of animals, only 2-yr males fattening during winter will be sampled (2-yr animals represent the most expected animals). The samples will be taken from the longissimus dorsi muscle rib 5-8 (500g/sample). Part of the sample from rib 5 will be exposed to quick freezing using liquid Nitrogen for enzymes analysis (4 enzymes including glycolytic and oxidative muscle metabolism) will be placed in small plastic containers and sealed. The rest of samples will be packed and stored below -40°C and then used for chemical analysis. Muscle from rib 6 will be used for determination of fat content, however, the muscle from rib 7 & 8 will be used for measuring shear force and connective tissue strength of the muscles. They will be packed under vacuum and stored at -20°C until time of analysis. The sample size is determined according to the high cost of chemical analysis.
  - 6- Meat samples will be analyzed in University of Khartoum, Sudan and some analysis, not available in Sudan, will be achieved at INRA, France. In Khartoum University, proximate analysis will take place for determination of protein, total and soluble collagen, color, fat and ash as well as sensory evaluation for meat quality attributes: Juiciness, moisture, color, fatty acid composition, tenderness and texture. At INRA-France, enzymes, myosin heavy chain by electrophoresis and shear force will be analysed.
  - 7- The scores of step 3 will be analysed to classify the carcasses in the abattoir using visual assessment of carcass conformation, fatness and carcass weight. Carcass classification of ruminants is based on EUROP carcass classification system which is used to assess conformation and fat classes in addition to carcass weight, (Jorgen, et.al 2006, Fisher & Heal, 2001). EUROP classification has five classes for conformation (from E= good, to P= bad) and fatness score has five classes from 1= lean, to 5= fat (Jorgen et.al, 2006, Russo, et. al 2003 and Fisher & Heal, 2001).
- \* The statistical analysis will be adapted according to the different steps. Variance analysis will be achieved to assess the effect of different variation factors (type of finishing, type of slaughterhouse) on quantitative variables describing body measurements (step 2), carcass characteristics (step 3) and meat quality (step 6). Rank correlation will be used for scoring data (BCS- step 2, class of carcasses-step 7). Multivariate analysis (factorial analysis and classification) will be used to identify the types of carcasses (step 7)

**Your research plan (continued)**

After the data treatment, it is expected to valorize results in international journal (meat sciences), international conferences ( ex. ISOCARD 2012) and local publications ( Sudan journal of animal production and leaf let for professional use).

Finally, we expect to contribute for proposition of new rules concerning carcass classification of camel meat in Sudan.

**References:**

Abdelhai O, Babiker S.A., Jailler R., Picard B., Jurie C., Hocquette J.F., Faye B., Effect of season on muscle characteristics of desert camel (*Camelus dromedarius*). Submitted in Meat Sciences

Faye B., Bengoumi M., Cleradin A., Tabarani A., Chilliard Y., (2001). Body condition score in dromedary camel: a tool for management of reproduction. Proc. of the International twin conf. On reproduction/production in camelids.. Al-Ain, Nov. 11-13, 2001, U.A.E. Emir. J. Agric.Sci., 13, 1-6

Fisher, A and Heal, J. (2001). Carcass classification. Beef & Sheep 2001, p. 314. Livestock Knowledge Transfer, a DEERA initiative, operated by ADAS/IGER/ University of Bristol.

Jorgen J. Are H. A., Bjorg E., Knut, K. and Morten, R. (2006). Validation of the EUROP system for lamb classification in Norway, repeatability and accuracy of visual assessment and prediction of lamb carcass composition. Meat Science 74: 497 - 509.

Russo, C; Prezioso, G. and Verita, P. (2003). EU carcass classification system: Carcass and meat quality in light lambs. Meat Science, 64: 411 - 416.

#### 9.12 Time schedule for your research project

How long will your IFS project last?	24 months
When do you wish to start your project?	12/10 (month/year)

Detailed plan of activities:

Activity (for example: questionnaire surveys)	Duration of Activity in Months (for example: Month 2 – 5)
	Season 1: Mar. - Jun. 2009
Step 1, retrospective questionnaire (season 1)	March - June 2009 (applied in 3 slaughter house)
Step2: body measurements (season1)	Mar. - Jun. 2009 (applied in 3 slaughter houses).
Step3: Observation of slaughtering conditions (season1)	Mar. - Jun. 2009 (applied in 3 slaughter houses).
Step4: Carcass measurements (season 1)	Mar. - Jun. 2009 (applied in 3 slaughter houses).
Step5: Meat sampling (season 1),	Mar. - Jun. 2009 (applied in 3 slaughter houses).
Repeat step 1-5 in season 2 and 3	Season (2): July-Oct. 2009/ Season (1): Nov.-Feb. 2010.
Step6: Meat analysis in Sudan	March-April 2010.
Step6: Meat analysis in France	May-July. 2010.
Step 7: Carcass classification proposal	Aug-Sept 2010.
Step 8: Butcher questionnaire	Oct. - Nov. 2010.
Data analysis and writing scientific papers	Dec. 2010 - Mar. 2011.

## 10 FACILITIES AND FUNDING

#### 10.1 List facilities available at your Institution

- Ph meter for the measurement of muscle pH.
- Deep freezer: for storage of samples in - 18 degree centigrade until the time of analysis.

#### 10.2 List any other funds that you or your Institution have obtained or applied for this project

Donor	Time Frame	Amount (USD)
French embassy	3 months	5000

If you have co-funding for your research, please give details of why IFS support is needed to complement your other support:

French embassy will support only travel Sudan-France and scholarship in France. However, the cost of laboratory analysis is not covered by French cooperation. University of Kordofan can support only basic analysis. IFS is crucial to support other costs of this project mainly lab. analysis, documentation and some equipments.

Have you at any time applied for or received support from TWAS or IFS for this research? If so, give details:

Yes, my second proposal to IFS was still not retained. The main reason was "there is no convincing evidence that Mr Abdelhai has the scientific skills in meat processing (...)" However, I worked on camel meat quality now for more than 5 years with convenient publications in the nineline in collaboration with powerful team in this scientific sector.

**11 ESTIMATED BUDGET** (please note that institutional overheads/charges are not accepted)

11.1 Equipment (Specify and describe each item)	COST IN USD
Weighing balance	200
liquid nitrogen container (3 liter)	1 500
Vacuum backing machine	1 500
Estimated freight charges, insurance, tax for items to be imported:	
	Sub-total: 3,200.00
11.2 Expendable supplies	
Cost of preparation of questionnaire (see work plan step 1,3 and 8)	200
Cost of purchasing liquid Nitrogen for 3 seasons	750
Cost of meat analysis in Sudan (proximate analysis, sensory analysis)	1 500
Cost of qnqlisis in France (enzymes, muscle fibre, collagen, colour, fatty acid composition, shear force and total fat)	4 250
Estimated freight charges, insurance, tax for items to be imported:	
	Sub-total: 6700
11.3 Literature, documentation, information	
Books, photocopy and supsciptioin in scientific on line journals (meat science)	500
Sub-total:	500
11.4 Local travel	
Local travel to visit the abattoirs in 3 different regions in Sudan	1 000
Sub-total:	1 000
11.5 Extra manpower	
Salary to 3 workers in the 3 abattoirs for 3 seasons (handling and measuring carcasses)	600
Sub-total:	600
Other costs (specify details)	
Sub-total:	
<b>TOTAL PROJECT BUDGET (USD):</b>	<b>12 000</b>

*Note: Maximum budget request is USD 12,000*

**11.6 List the items you request funding for in the budget, describing their function, explain their cost, and defend their use in the research project.**

- 1/ weighing balance: is used for weighing of carcasses. It is crucial to know exactly the carcass weight and the differences between carcasses in weight during sampling.
- 2/ Preparation of questionnaire: The questionnaire design, print out and photo copy. It need to collect retrospective data on farming conditions and animals, slaughtering conditions and consumer preferences of camel meat.
- 3/ Liquid Nitrogen container: Important to store the liquid Nitrogen which will be used for freezing the samples of the longissimus dorsi muscle taken from (rib 5) for the analysis of enzymes.
- 4/ Purchase of books and subscription in on line journals: Needed to know the experience of other people in the same field of study and make use of their findings and also compare them with the results that will be achieved from the current study.
- 5/ Vacuum packing machine: Packing samples under vacuum to prevent contamination and keeping samples in a good condition during freezing until the time of analysis.
- 6/ Manpower is needed to help in handling and carcass measurements. 100\$ / month will be paid for 3 assistances in the 3 abattoirs. The salary will be extended for 9 months for each assistant during the seasons 900\$. A sum of 1800\$ will be the total cost of payments to 3 assistants for the accomplish of the work.
- 7/ Cost of the analysis is 5750\$. It is needed for the analysis of meat samples in Sudan and France. The actual cost of analysis was higher than the amount mentioned, but it was reduced in the frame of the Sudanese French collaboration.

**12. HOW DID YOU LEARN ABOUT IFS?**

How did you learn about IFS?

My supervisor	Other:
---------------	--------

How did you get the application form?

from IFS Web	Other:
--------------	--------

**Thank you for your electronic application to IFS.**

**Save your completed application form on your computer or a diskette and  
send the completed form as an e-mail attachment to:**

applications@ifs.se

**Please airmail the signed first page of the form to:**

International Foundation for Science  
Karlavägen 108, 5th floor  
SE - 115 26 Stockholm  
Sweden

More information is available on the Internet at: [www.ifs.se](http://www.ifs.se)

Version 1.7a, December 2005

