Executive Summary

OF

THE PROJECT ENTITLED

"Environmental Monitoring and Occupational Stresses in Dairy Industry"

Submitted to

UNIVERSITY GRANTS COMMISSION, NEW DELHI

By

Dr. Mrs. Manjiri Ajit More

Head of Zoology Department
G.K.G. College, Kolhapur – 416012

2015

Shikshan Prasarak Mandal's
GOPAL KRISHNA GOKHALE COLLEGE, KOLHAPUR.
'B' Ward, Subhash Road, Kolhapur Pin- 416 012.
Phone No- (0231) 2642540 Fax No.-(0231) 2642340
E-Mail :gkg1_college@rediffmail.com Web Site:- www.gkgcollege.co.in
Vice Prin. Smt. H. V. Bhosale M. Sc., B.Ed.
Prin. Dr. J. B. Pishte M. Sc., Ph.D.(Geol.)

Ref.No.GKG/ 64 /2015-16 Date: 03/02/2016

25 APR 2016

To,
The Joint Secretary,
University Grants Commission,
Western Regional Office,
Ganesh Khind,
Pune-411007.

Sub.:- Submission of utilization certificate and final report of Minor research project of Dr. Mrs. Manjiri Ajit More.
Ref.:- Your letter No. File No. F-47-020/12 (W.R.O.) Dated 27/08/2013

Sir,

With reference to above letter dated 27/08/2013 Dr. Mrs. M.A.More, Assistant Professor in Zoology from our college received a sanctioned letter of minor research project emitted "Enviornmental Monitoring and Occupational Stresses in Dairy Industry." The amount sanctioned for the said project is Rs.1,00,000/- (Rupees one lakh only). The amount received from the said project is Rs. 80,000/- (Rupees Eighty Thousand only) and the actual amount paid on this project is Rs. 1,19,903/- (Rupees One lakh Nineteen Thousand Nine Hundred and three only). The completion report of the said project is submitted herewith.

Kindly accept the same and release the remaining grant of Rs.39,903/- (Rupees Thirty Nine Thousand Nine Hundred and Three only) as early as possible and oblige.

Thanking you,

Yours faithfully,

Principal,
Gopal Krishna Gokhale college,
Kolhapur.

UNIVERSITY GRANTS COMMISSION
WESTERN REGIONAL OFFICE
GANESHKHIND, PUNE – 411007

Phones: (020) 25696897,
25691477, 25691178,
Fax: (020) 25691477
Web site: www.ugc.ac.in

No: 47-020/12(WRO)

Accounts Officer
versity Grants Commission
eshkhind, Pune-411007.

– 5 FEB 2013

bject: Financial assistance to college teachers for undertaking Minor Research Projects – Release of first installment during XII[th] Plan.

Madam,

The UGC on the recommendations of the Expert Committee has approved the Minor search Project entitled "Environmental Monitoring and Occupational Stresses in Dairy ustry" in the subject- **Environmental Science** to be undertaken by **Dr. Desai M. J., GOPAL RISHNA GOKHALE COLLEGE, B WARD, SUBHASH ROAD, KOLHAPUR-416 012.** e financial assistance of the UGC would be limited to Rs. 100000/-(Rupees Only) for a period two years. An amount of Rs. **80000/-** (Rupees Only) is presently being sanctioned as the first tallment.

on-Recurring rant for Two ears	Amount (Rs)	Recurring grant	1st Year Amount	2nd Year Amount	Head of a/c
ooks & Journals	0	Contingency	5000	5000	4(iv)b (For General) 1.B(i)h(i)b (For SC) 1.B(i)h(i)b (For ST)
quipment	60000	Special Need	0	0	
		Travel/Field work	10000	10000	
		Chemicals & Glassware	5000	5000	
		Others	0	0	
otal (Rs.)	60000		20000	20000	

otal amount for the project: Rs. 100000/-

ne grant is subject to the terms and conditions as mentioned below.

1. A Certificate of Acceptance of the conditions governing the research project should be sent immediately to this office.
2. The amount of the grant shall be drawn by the Accounts Officer (D.D.O), University Grants Commission on the grant-in-aid bill and shall be disbursed to and credited to the above-mentioned institute through D.D./ RTGS Confirmation No/ NEFT/ Transfer No.
3. The sanctioned amount is debatable to the Major Head 4(iv)b(For General), 1.B(i)h(i)b (For SC), 1.B(i)h(i)b (For ST) and is valid for payment during the financial year 2012 -2013 only.
4. The grant is subject to adjustment on the basis of Utilization Certificate in prescribed proforma submitted by University/College/Institute.

NOTE:

1. **The grant shall not be used self-financial/ non-grant/unaided courses & teachers.**
2. **Date of implementation will be the date of sanction of first installment.**
3. **The researcher is required to submit an Acceptance Certificate of the project in the enclosed format to the affiliating university, which would then be sent to UGC (WRO) in a bunch by the University.**

UNIVERSITY GRANTS COMMISSION
WESTERN REGIONAL OFFICE
GANESHKHIND, PUNE - 411 007

Phones: (020) 25691477,
25691178, 25696897
Fax: (020) 25691477
Web site: www.ugc.ac.in

By Registered Post

F. No. 47-020/12(WRO)

July 10, 2013

THE PRINCIPAL,
GOPAL KRISHNA GOKHALE
COLLEGE,B WARD,
SUBHASH ROAD,
KOLHAPUR - 416 012.

Subject: Release of grant through D D. No. / RTGS Confirmation No./ NEFT/ Transfer No.

Sir/Madam,

Please find enclosed D.D.No./ RTGS Confirmation No/ NEFT/ Transfer No. pertaining to release of grant-in-aid to your college as per following details:

- **P.I.**: - Dr. Desai M. J.
- **Sanction letter reference:** - 47-020/12(WRO), Dated 24.05.13
- **Name of the Scheme:** - MRP (Science)
- ***To your College by way of D D. No. / RTGS Confirmation No./ NEFT Transfer No.*** **:** - P13062438203590
- **From UGC Bank Name:** - Canara Bank
- **Dated:** - 22.06.13
- **Amount: - Rs.** 80000/-

Kindly acknowledge of this letter.

Yours faithfully,

Sd/
(Accounts Officer)

(Since it is a computer-generated letter, signature is not necessary)

Encl: Acknowledgement

ACKNOWLEDGEMENT FOR THE GRANTS RECEIVED FROM UGC (WRO), PUNE
to be returned immediately on receipt of (DD No./RTGS Confirmation No./NEFT/Transfer No.)

SHIVAJI UNIVERSITY, KOLHAPUR-416 004 MAHARASHTRA
PHONE EPABX-2609000,2693643 □ GRAM:UNISHIVAJI
□ FAX : 0091-231-2691533 & 0091-231-2692333
शिवाजी विद्यापीठ, कोल्हापूर-४१६ ००४, महाराष्ट्र
दूरध्वनी : (ईपीएबीएक्स) 2609000 (दहा लाईन्स)
□ तार : युनिशिवाजी □ फॅक्स : 0091-231-2691533 व 0091-231-2692333
Vice-Chancellor Office Fax - 0091-231-2691533
Registrar Office Fax - 0091-231-2692333
C.O.E.Office Fax - 0091-231-2693173

B
Accredited By NAAC

Ref.No: SU/STAT/F-21/ 174

Date: 14 JUN 2011

To,
The Joint Secretary,
University Grants Commission,
Western Regional Office,
Pune University Campus,
Ganeshkhind,
Pune – 411 007.

Sub: Financial Assistance for Minor Research Projects.

Sir,

With reference to the subject mentioned above, I am forwarding herewith proposals for minor research projects in duplicate/triplicate for financial assistance received from following teachers-

Sr. No	Teachers Name	Subject	Title of the Proposal
	Gopal Krishna Gokhale College, Kolhapur		
1.	Dr.Manjiri J. Desai	Zoology	"Environmental Monitoring ------in Dairy Industry."
2.	Mrs. D. S. Patil	Botany	"Awareness ----------Biopesicides."
	Vivekanand College, Kolhapur		
3.	Dr.Ramesh V. Dengle	Chemistry	"A Convenient,Cost -------1,5-Benzothiazepines."
4	Dr. Hindurao B. Patil	Marathi	"Study of Marathi----on internet."
	Krantisinh Nana Patil College, Walwa, Dist. Sangli		
5.	Mr. Krishnat R. Jadhav	Geography	"Socio-Agricultural----------a Geographical Analysis."

I am, therefore, to request you to kindly consider the above proposals favourably and sanction the necessary financial assistance.

Thanking you,

Yours faithfully,

Director
Board of college and
University Development

Encl: - As above.

Copy to:-

1. The Principal,
2. Manjiri J. Desai
3. Mrs. D. S. Patil
   Gopal Krishna Gokhale College,
   Kolhapur.

5. The Principal,
6. Dr.Ramesh V. Dengle
7. Dr. Hindurao B. Patil
   Vivekanand College,
   Kolhapur.

8. The Principal,
9. Mr. Krishnat R. Jadhav
   Krantisinh Nana Patil College,
   Walwa, Dist. Sangli.

जुने नाव व नोंदणी क्रमांक	नवीन नाव व पत्ता	जुने नाव व नोंदणी क्रमांक	नवीन नाव व पत्ता
यास्मीन अ.रहीम सनार (क-३,५८२)	यास्मीन अमजद मुजावर मान नगर, ... ता. हातकणंगले, जि. कोल्हापूर-४१६ ...	गंगाराम मल्लाप्पा दांडगळ (क-३,५९५)	गंगाराम मल्लाप्पा बंडगर मु. पो. दिघंची, ता. आटपाडी, जि. सांगली-४१५ ३१५
सिमा शंकर माने (क-३,५८३)	सिमा सचिन शिंदे मु. पो. टाकवडे, ता. शिरोळ, जि. कोल्हापूर-४१६ १२१	स्मिता गोरखनाथ सावंत (क-३,५९६)	स्मिता समाधान पवार मु. लोणारवाडी, पो. ता. आटपाडी, जि. सांगली-४१५ ३०१
कु. अश्विनी बाबासो काळे (क-३,५८४)	सौ. अश्विनी शितल कांबळे मु. पो. हलसवडे, ता. करवीर, जि. कोल्हापूर	वंदना तुकाराम माळी (क-३,५९७)	वंदना तुकाराम जाधव मु. पो. ता. आटपाडी, जि. सांगली-४१५ ३०१.
दत्तात्रय काशिनाथ गुत्तेदार (क-३,५८५)	दत्तात्रय काशिनाथ भंडारी १४४, करंजे भिझेकरी गृहाजवळ, जरंडेश्वर नाक्याशेजारी, कृपर बाग, सातारा-४१५ ००२.	ओंकार तुकाराम माळी (क-३,५९८)	ओंकार तुकाराम जाधव मु. पो. आटपाडी, ता. आटपा जि. सांगली-४१५ ३०१.
जयंती अशोक साजणे (क-३,५८६)	नेहा भरत पाटील मु. पो. वसगडे, ता. करवीर, जि. कोल्हापूर-४१६ २०२.	तुकाराम विठ्ठल माळी (क-३,५९९)	तुकाराम विठ्ठल जाधव मु. पो. आटपाडी, ता. आटपा जि. सांगली-४१५ ३०१.
विजय महावीर पाटील (क-३,५८७)	विजयकुमार महावीर पाटील मु. पो. वसगडे, ता. करवीर, जि. कोल्हापूर-४१६ २०२.	विशाल तुकाराम माळी (क-३,६००)	विशाल तुकाराम जाधव मु. पो. आटपाडी, ता. आटप जि. सांगली-४१५ ३०१.
श्रीदेवी मोहन पाटील (क-३,५८८)	सारिका सिदगोंडा पाटील मु. पो. वसगडे, ता. करवीर, जि. कोल्हापूर-४१६ २०२.	उषा सुग्रिव गव्हाणे (क-३,६०१)	उषा पोपट पाटील मु. पो. आटपाडी, ता. आटप जि. सांगली-४१५ ३०१
श्लोक सिदगोंडा पाटील (क-३,५८९)	ऋतूराज सिदगोंडा पाटील मु. पो. वसगडे, ता. करवीर. जि. कोल्हापूर-४१६ २०२.	संजिवनी दत्तू कुरळुपे (क-३,६०२)	संगिता विनोद कांबळे घ. नं. २८१८ सी, सिध्दार्थ न कोल्हापूर-४१६ ००२
कुसूम राजगोंडा पाटील (क-३,५९०)	पदमश्री विजयकुमार खूळ मु. पो. वसगडे, ता. करवीर, जि. कोल्हापूर-४१६ २०२.	मनिषा अरूण विरकर (क-३,६०३)	मनिषा संदिप लवटे १३५/ए, संजय गांधी कॉलनी, राजेश मोटर्स समोर, कावळा नाका, कोल्हापूर-४१६ ००३
मंजिरी जयकुमार देसाई (क-३,५९१)	सौ. मंजिरी अजित मोरे ९०७, रविवार पेठ, बी वॉर्ड, कोल्हापूर-४१६ ०१२.	सारिका दामोदर पाडळकर (क-३,६०४)	सौ. सारिका अभिजीत पाट मु. पो. तिटवे, ता. राधानग जि. कोल्हापूर.
कु. शुभांगी शंकर निंबाळकर (क-३,५९२)	सौ. साधना संग्राम देसाई दर्गा चौक, बाजार पेठ, हुपरी, ता. हातकणंगले, जि. कोल्हापूर-४१६ २०३	कु. छाया आण्णाप्पा उर्फ आनंदा कॅबळे (क-३,६०५)	सौ. छाया तुकाराम शि मु. पो. कोरोची, ता. हातक जि. कोल्हापूर
हणमंत मल्लाप्पा दांडगळ (क-३,५९४)	हणमंत मल्लाप्पा बंडगर मु. पो. दिघंची, [illegible] [illegible]	राणीबाई नामदेव देशमाने [illegible]	विजया धनंजय [illegible] [illegible] [illegible]

To,

The Accounts Officer,

University Grant Commission,

Western Regional Officer,

Ganseshkhind, Pune – 410007

Subject - **Submission of final project report and**

Expenditure statement incurred during 2013 to 2015.

Respected Sir,

I am herewith submitting the final report of the UGC Minor Project entitled "Environmental monitoring and occupational stresses in Dairy Industry" sanctioned to Dr. Mrs. Manjiri Ajit More and the expenditure statement incurred during 2013-2015 for working of the same. This is for your kind information and perusal.

With regards.

Thanking you,

Yours Sincerely,

Principal

Gopal Krishna Gokhale College

Kolhapur

Shikshan Prasarak Mandal's

Gopal Krishna Gokhale College, Kolhapur

Statement of Income-Expenditure Account

Accounts for UGC 10th Plan

Allocated Grants Amount Rs. 80,000/-

In respect of UGC Minor Research Project in Dept. of Zoology. G.K.G. College, Kolhapur entitled "Environmental monitoring and Occupational stresses in Dairy Industry".

Approved by UGC vide letter file no. F - 47-020/12(WRO) dated 27-08-2013

Income		Expenditure	
Grants received in advance from University Grant Commission (WRO) as per letter No. 47-020/12 (WRO) dt. 27.08.2013	80,000.00	Books & Journals Equipments Chemicals (Glassware) Contingency Field work Travel	 75,453.00 10,688.00 10,302.00 23,460.00
To Principal G.K.G. College, Kolhapur	39,903.00		
Total	1,19,903.00	Total	1,19,903.00

Grant Sanctioned Rs. 1,00,000.00

Less : 1st Instalment Rs. 80,000.00

Received from UGC

Receivable grant amount from U.G.C. Rs. 39,903.00

Principal Investigator
Dr. Mrs. Manjiri Ajit More
Zoology Department
G. K. G. College, Kolhapur.

Principal
Gopal Krishna Gokhale College,
Kolhapur

UTILIZATION CERTIFICATE

It is certified that the Rs. 80,000/- of grants in aid sanctioned during the year 2013-2015 to Dr. Mrs. Manjiri Ajit More under University Grants Commission, Western Regional Office, Ganeshkhind, Pune order no. F. 47-020/12 (WRO) dt. 27.08.2013 towards 1,19,903/- has been fully utilized for the purpose of the project work for which it was sanctioned and in accordance with the terms and conditions laid by the commission.

If as a result of check or audit objection some irregularity is noticed at a later stage, action will be taken to refund or regularized the objected amount.

The total expenditure incurred for this project is Rs. 1,19,903.00 (Rs. One lakh Nineteen thousand Nine hundred and three only)

GAWADE & ASSOCIATES

(A. A. GAWADE)
PROPRIETOR

GAWADE & ASSOCIATES • CHARTERED ACCOUNTANTS • KOLHAPUR 127037W

UGC Minor Research Project

Dr. Mrs. Manjiri Ajit More

Enviorr.mental Monitoring .... In Dairy Industry

Particulars of Receipts	Amount Rs.	Itemwise Expenditure	Amount Rs.
UGC Grant F-47-020/12	80,000.00	1. Digital Lux Meter - 3	11,408.00
(WRO) Dt. 27.08.2013		2. Hand grip dynamometer-3	9,902.50
		Peak Flow Meter - 3	
		3. Digital Sound Level Meter - 3	17,820.00
		4. Digital Sound Level Meter - 3	19,643.00
		5. Peak Flow Meter - 3	1,600.00
		6. B.P. Monitor - 4	8,320.00
		7. Digital Lux Meter - 2	6,760.00
		8. Glassware Material	10,688.00
		9. Zerox, Typing and Stationary (Vch. No. 9 to 17)	10,302.00
		10. Travelling (Vch. No. 18 to 30)	23,460.00
Total	80,000.00	Total	119,903.50
Grand Total	80,000.00	Grand Total	119,903.00

GAWADE & ASSOCIATES

(A. A. GAWADE)
PROPRIETOR

GAWADE & ASSOCIATES • CHARTERED ACCOUNTANTS • KOLHAPUR

University Grants Commission

Western Regional Office

Ganeshkhind, Pune – 410007

Statement of expenditure in respect of Minor Research Projet under the scheme support of research in minor research project.

1. Name of Principal Investigator — Dr. Mrs. Manjiri Ajit More
2. Dept. of University / College — Department of Zoology, G.K.G. College, Kolhapur - 416012
3. U.G.C. approval No. and Date — F-47-020/12 (WRO) dated 27.08.2013
4. Title of the research project — Environmental monitoring and occupation stresses in Dairy Industry
5. Effective date of starting — 01.09.2013
6. (a) Period of Expenditure — From 01.09.2013 to 30.08.2015
   (b) Details of Expenditure

Sr. No.	Heads	Sanction Amount (Rs.)	Received Amount (Rs.)	Expenditure Incurred (Rs.)
1	Books & Journal	--	--	--
2	Equipment	60,000.00	60,000.00	75,453.00
3	Contingency	10,000.00	5,000.00	10,302.00
4	Field work / Travel	20,000.00	10,000.00	23,460.00
5	Chemicals	10,000.00	5,000.00	10,688.00
6	Hiring Services	Nil	Nil	Nil
7	Over head charge	Nil	Nil	Nil
	Total	1,00,000.00	80,000.00	1,19,903.00

Equipment

Sr. No.	Bill No.	Date	Order No.	Order dt.	Amount	Remark
1	133	28.06.2013	As per oral discussion	15.06.2013	11408.00	By cash
2		05.08.2013	Through email		9902.50	By D.D.
3	134	10.08.2013	As per oral discussion	15.06.2013	17820.00	By Cash
4	134	10.08.2013	As per oral discussion	15.06.2013	19643.00	By cash
5	771	22.08.2013		26.07.2013	1600.00	
6	AAACWBB725FSD001			13.08.2013	8320.00	
7	434	08.04.2014	As per oral discussion	08.04.2014	6760.00	By Cash
				Total	75453.50	
				Grand Total	75453.00	

Glassware

Sr. No.	Bill No.	Date	Order No.	Order dt.	Amount	Remark
1	328	07.10.2016		03.10.2013	10,688.00	By Cash
				Total	10,688.00	

Bill List (Contingency)

Sr. No.	Name	Date	Bill No.	Amount
1	Gurudev System Service, Mirajkar Tikti, Kolhapur	25.04.2013	34	1,200.00
2	Kedarnath Enterprises	25.04.2013		1,200.00
3	Gurudev System Service, Mirajkar Tikti, Kolhapur	07.06.2013	66	940.00
4	Gurudev System Service, Mirajkar Tikti, Kolhapur	14.12.2013	83	1,905.00
5	Rahul Xerox (Nr. GKG College, Kop.)			500.00
6	Gurudev System Service, Mirajkar Tikti, Kolhapur	08.04.2014	11	1,005.00
7	Gurudev System Service, Mirajkar Tikti, Kolhapur	26.06.2014	39	990.00
8	Gurudev System Service, Mirajkar Tikti, Kolhapur	21.12.2014	92	1,200.00
9	Rahul Xerox (Nr. GKG College, Kop.)	15.01.2015		490.00
10	Gurudev System Service, Mirajkar Tikti, Kolhapur	16.01.2015	114	872.00
				10,302.00

Field & Travel

Sr. No.	Place	Date	Amount
1	G.K.G. College to Gokul Dudh Sangh (Gokul Shirgaon)	07.09.2013	900.00
2	G.K.G. College to Gokul Dudh Sangh (Gokul Shirgaon)	12.10.2013	900.00
3	Kolhapur to Washi (New Mumbai and Other) to Kolhapur	12.11.2013	8,590.00
4	G.K.G. College to Gokul Dudh Sangh (Gokul Shirgaon)	07.12.2013	750.00
5	G.K.G. College to Gokul Dudh Sangh (Gokul Shirgaon)	26.12.2013	900.00
6	G.K.G. College to Gokul Dudh Sangh (Gokul Shirgaon)	15.02.2013	900.00
7	G.K.G. College to Gokul Dudh Sangh (Gokul Shirgaon)	10.05.2013	900.00
8	Kolhapur – Pune – Kolhapur	16.05.2014	5,420.00
9	G.K.G. College to Gokul Dudh Sangh (Gokul Shirgaon)	31.03.2014	900.00
10	G.K.G. College to Gokul Dudh Sangh (Gokul Shirgaon)	10.06.2014	900.00
11	G.K.G. College to Gokul Dudh Sangh (Gokul Shirgaon)	30.10.2014	750.00
12	G.K.G. College to Gokul Dudh Sangh (Gokul Shirgaon)	07.11.2014	900.00
13	G.K.G. College to Gokul Dudh Sangh (Gokul Shirgaon)	08.01.2015	750.00
		Total	**23,460.00**

Principal Investigator
Dr. Mrs. Manjiri Ajit More
Zoology Department
G. K. G. College, Kolhapur.

Principal
Gopal Krishna Gokhale College,
Kolhapur

UNIVERSITY GRANTS COMMISSION

Western Regional Office,

Ganeshkhind, Pune - 410007

Statement of Expenditure in respect of minor research project under the scheme support of research in minor research project

1. Name of Principal Investigator : Dr. Mrs. Manjiri Ajit More
2. Dept. of University / College : Department of Zoology,

   Gopal Krishna Gokhale College, Kolhapur
3. UGC approval no. and date : F-47-020/12 (WRO) dt. 27/08/2013
4. Title of the research project : Environmental Monitoring and Occupational

   Stresses in Dairy Industry
5. Effective date of starting the project : 01/09/2013
6. (a) Period of Expenditure : From 01/09/2013 to 30.08.2015

   (b) Details of Expenditure :

Sr. No.	Heads	Sanction Amount	Received Amount	Expenditure Incurred
1	Books & Journals	...	...	...
2	Equipments	60,000.00	60,000.00	75,453.00
3	Contingency	10,000.00	5,000.00	10,302.00
4	Field Work / Travel	20,000.00	10,000.00	23,460.00
5	Glassware	10,000.00	5,000.00	10,688.00
6	Hiring Services	...	...	...
7	Other Head Charges	...	...	...
		1,00,000.00	**80,000.00**	**1,19,903.00**

UTILIZATION CERTIFICATE

For Year 2013-2015 (01.09.2013 to 30.08.2015)

1	Title of the Project / Scheme	Environmental Monitoring & Occupational Stresses in Dairy Industry
2	Name of the Institute	Department of Zoology, G.K.G. College, Kolhapur
3	Principal of the Investigator	Dr. Mrs. Manjiri Ajit More
4	UGC sanction order no. and of sanctioning project	F-47-020/12 (WRO) dt. 27.08.2013
5	Head of account as given in the original sanction under	Books Equipments 75,453.00 Contingency 10,302.00 Fieldwork / Travel 23,460.00 Glassware 10,688.00
6	Amount brought forward from the preview year quoting UGC letter no. and date in which the authority to carry forward the said amount was given	NIL
7	Amount received during the financial year (Please given UGC letter / order no. and date)	80,000/-
8	Total amount that was available for expenditure (excluding commitments) during the financial year	80,000/-
9	Actual expenditure (excluding commitments) incurred during the financial year (Sept. 2015)	1,19,903/-

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CHAPTER I

Introduction

Dairy is a milk processing industry. It provides and assures a steady source of subsidiary income to the rural population of India. Although dairying period could be traced into Vedic times the modern dairy industry took roots in 1949 in Mumbai as Aarey Milk Colony and Anand in Gujarat in 1946. Under the project known as 'Operation flood' with the help of 'World Flood Programme (WFP)', the first large scale milk development started. The 'Operation Flood Programme' was launched in 1970-71 in India. Under operation flood the national milk grid was erected to link the rural milk sheds to major demand centres in Urban areas. India became largest milk producer in the world in 1999. The White Revolution has created opportunities for the dairy farmers to improve employment, increase in income. The dairy industry has helped rural economy to liberalize and empower the poor farmers.

Kolhapur District Co-operative Milk Producers Union Ltd. 'GOKUL' Kolhapur

Dairy development programmes are based on two activities *i.e.* Dairy farming and dairy processing. Dairy processing is managed by three key players in the milk processing sector.

i) Co-operative unions
ii) Private and multinationals.
iii) Public sector dairy plants.

The Kolhapur District Co-operative Milk Producers Union Ltd., Kolhapur was established on 16th March, 1963. Under co-operative societies Act (Regd. No. KPR PRADIA102). In its formative years it supplied milk to government dairy in Tarabai Park, Kolhapur. In 1978, National Dairy Development Board included Kolhapur district under Operation Flood. This opened the flood gates of growth in dairy industry in this area. Under this programmer N.D.D.B. constructed 2 lac litres capacity dairy plant at Gokul Shirgaon. Under operation flood I, II and III chilling centres at Gandhinagar, Bidri, Gogave and Tawarewadi were constructed. The government milk scheme in Kolhapur was handed over to Kolhapur Dudh Utpadak Sangh in 1985 with the help of N.D.D.B. The sangh procures milk from 4977 village level milk societies affiliated to the Dudh Sangh. During the flush season the maximum milk procurement touches 7 Lac litres per day. Kolhapur District Co-operative Milk Producers Union Ltd. has won the Govt. of India National Productivity awards. (It has won the following awards.)

- National Productivity Award for year 2006-07.
- First Best Award for the year 1992-93 in the category of Dairy Processing Industry.
- Second Best NPC Award in the category of Animal feed processing units for the year 1992-93.
- First Best Award for the year 1989-90 in the category of Milk Product Plant.

Areas of Operation :

i) Karvir, ii) Kagal, iii) Chandgad, iv) Gandhinglaj, v) Ajara, vi) Radhanagari, vii) Gaganbawada, viii) Bhudargad, ix) Shahuwadi, x) Panhala, xi) Shirol, xii) Hatkanangale.

However, 41 villages from Hatkanangale and Panhala Talukas are affiliated to Warana Milk Producers Union.

Objectives of the Milk Union :

- Undertake activities of procuring clean and quality milk.
- To give dairy farmers remunerative price throughout the year for qualitative product.
- Marketing of the milk products.
- To supply surplus milk to other cities, towns for consumption of consumers.
- To convert conventional Dairy Co-operatives into Anand Pattern and regular monitoring of their functions through extension services.
- To take up activities for development of dairying through dairy co-operatives.
- To take fodder development activities on large scale.
- To create awareness and encourage women's participation in day to day activities of milk production.

The Gokul dairy plant was originally designed to handle 2 lakh litres of milk per day is now handling up to a maximum 24.61 crore litres of milk. It is one of the largest milk unions in Western Maharashtra. Totally 1891 people are employed in the various units of the Kolhapur Dudh Utpadak Sangh Ltd.

All these members are engaged in various activities like milk collection, milk processing, marketing, engineering maintenance and production of milk product, transportation. The various sections of the dairy plant are :

1. Milk Reception Section / Doc / Receiving
2. Milk Processing Section namely pasteurization and chilling.
3. Milk Pouching Section
4. Production Section
5. Cold Storage
6. Engineering and maintenance
7. Godown http://google.com/accounts

Four sections are selected to study the environment and occupational stress in dairy industry.

1) Milk Reception / Doc : Here milk collected from the various sources is received. Smelling test for the received milk in the cans is carried out and sour milk is discarded. The cans of Buffalo milk and cow milk are separated. Milk is graded, weighed and sampling is done. After tipping and filtration milk is stored in dump tank. Empty cans are washed and cleaned.

2) Boiler Section : Boiler plays a vital role in the dairy industry. It is the most preferred heating medium. Boiler is mainly used for steam generation which is used in most of the sections of the dairy plant. Gokul dairy plant has two steam boiler IAEC steam boiler J. N. Marshell make, 35 KL furnace oil tanks and three 20 KLPH water softners.

In dairy industry saturated steam is used for all purposes. Steam is used to wash milk cans and crates, to melt butter, to make ghee, to produce skim milk, for spray drying of skimmed milk powder, heat water, cleaning, sterilization and to produce various milk products. The area of boiler section is 196 sq. mt.

3) Refrigeration Section : Refrigeration section produces chilled water using ammonia gas. Ammonia gas is compressed and condensed to liquid and again vapourized. The compressors of 100 hp and 3 screw compressors with capacity of 350 hp are used. The use of ammonia gas makes the production cost effective. Depending on the requirement of the individual processing of the product, the products are chilled at the temperature varying from $-3^{o}c$ to $-20^{o}c$. Ammonia is used in two milk cold rooms, one butter cold room and four deep freezers to maintain temperature at $0^{o}c$ to $-4^{o}c$ and $-18^{o}c$ to $-20^{o}c$. The area of this section is 441 Sq. mt.

4) Cold Storages :

There are six cold storages. The area of cold storage is 357 Sq. mts. The cold storage is used to store the finished milk products. The temperature in the cold storage rooms varies from $-4^{o}c$ to $-20^{o}c$.

Work Place Environment and Occupational Stress in Dairy Industry

Work place environment includes physical, mechanical and organizational environment. An industrial worker works in a highly complicated and complex environment. There are three types of interactions in working environment.

i) Man and physical, chemical and biological agents.

ii) Man and machine.

iii) Man and man.

Occupational stress is one of the major health hazards of the modern work place. It accounts for much of the physical illness. Stressful working conditions have been linked to low productivity, absenteeism and increased rates of accidents. Occupational or job stress may be defined as mechanism where the human body reacts to stress and attempts to adapt to the environment.

Occupational stress is stress associated with work and work place.

When the source of stress is not identifiable and stress becomes excessive, repeated and prolonged it becomes distress and creates unhealthy physiological and psychological reactions. Many of the sources of stress at work have different character. They are more subtle, pervasive and outcome of variety of factor. A dairy industry worker may be exposed to five types of environmental hazards.

i) Physical hazard

ii) Chemical hazard

iii) Biological hazard

iv) Mechanical hazard

v) Psychological hazard

Categories involved in the occupational stress are

- Factors special to the job
- Role in the organization
- Career development
- Interpersonal work relationship
- Organizational structure / climate

The physical agents in working environment are increase humidity, air movement, light, radiation, vibrations, noise etc. These factors affect the health and efficiency of the workers.

The presence of the chemical agents like dust, toxins, gases and fumes cause health hazards at work place.

The biological agents like microbes, fungi and parasitic agents cause toxic effect on human beings.

The common physical hazards in dairy industry are heat and cold storage and cold rooms. The Milk Reception Doc workers are exposed to noise. They have to continuously stand and bend. The working environment in dairy industry includes cleanliness, light, noise, vibrations, ventilation, temperature, heat, humidity and dust particles. In refrigeration section the dairy worker is exposed to smell of ammonia gas. Night shifts and rotation of the shifts directly or indirectly affect the health of the dairy workers.

Objectives of the investigation

Dairy industry is the largest agro based industry in Western Maharashtra and has been contributing substantially to nation's economic growth. The workers health status and work environment are two important aspects to run this industry smoothly. Monitoring the environment to eliminate occupational stress and promote health and safety. Occupational stresses which later manifest into occupational hazards are prevalent in dairy industry. Identification of such occupational stresses is the need of the hour.

The study proposes to study the environmental monitoring and occupational stresses in workers of Kolhapur Zilla Dudh Utpadak Sangh Ltd., Kolhapur broadly known as 'Gokul Dairy'. The investigator proposes to study –

- All potential health hazards in terms of stress and strain.
- The existence of occupational stresses.
- Suggest suitable measures to reduce stress.
- Propose the ways to monitor work place environment of the dairy industry.
- Suggestion to improve workplace safety and promote highest degree of physical and mental well being. The dairy industry worker which will improve efficiency and productivity of the dairy worker.

CHAPTER II

Materials and Methods

The present study was carried out in the sections of Gokul Dairy Plant. The selected sections are i) Milk Reception / Doc ii) Boiler Section iii) Refrigeration Section iv) Cold storages.

The workers of these section were given some tests and information was collected through questionnaires. The information was gathered to study the work place environment and occupational stress.

Methods of assessment of work place environment :

a) Sound Measurement :

Sound level at selected sections for study was recorded using sound level meter of Lutron Ltd., China make and sound levels are presented in decibel.

b) Humidity :

Using hygrometer humidity was measured in various sections of the dairy plant.

c) Illumination :

Using lux. meter illumination levels of the areas of the selected sections was measured and the illumination level was recorded in lux.

d) Temperature :

Thermal data was collected using dry bulb temperature. The impact of cold temperatures was also studied and recorded.

Methods of Physiological evaluation of workers

The physiological response of the worker varies which helps to understand and evaluate the impact of the stress and occupational hazards at work place.

i) Physical Characteristics

Anthropometric measurements were used to study the physical characteristics. Weighing machine was used to record the weight of the workers. The workers height was measured in centimeters. Using the standard techniques of occupational physiology the physical characteristics like weight and height were recorded.

ii) Body Temperature

The workers body temperature was recorded using clinical thermometer. The axial temperature of the workers was checked and recorded on any of the working days.

iii) Pulse Rate

Carotid pulse was used to measure the pulse rate of the subjects. The pulse rate per minute was recorded.

iv) Blood Pressure

The Blood Pressure machine used in this study was of OMRON Ltd., Japan and was used to record the blood pressure of the workers working in the various sections of the plant on working day.

v) Hand Grip Strength Test

Dynamometer was used to measure the grip of the forearm muscle strength. The dynamometer used in this study was of Erose Ltd., INDIA.

vi) Breathing Rate

Breathing rate of the selected workers from the sections selected for the study was recorded.

vii) Peak Expiratory Flow Rate

Using Peak Flow Meter Peak Expiratory Flow Rate was recorded. The peak flow meter used in this study was of JSB Healthcare Ltd.

Using these standard methods physiological health status of the workers from the selected sections was assessed. The workers were randomly selected from each section and administered various tests to evaluate their impact of the stress factors. Questionnaire was used to collect the required information and data.

Fig. No. 1 : Peak Flow Meter

Fig. No. 2 : Blood Pressure Monitoring Machine

Fig. No. 3 : Lux Meter

Fig. 4 : Sound Level Meter

Fig. No. 5 : Grip Dynamometer

CHAPTER III

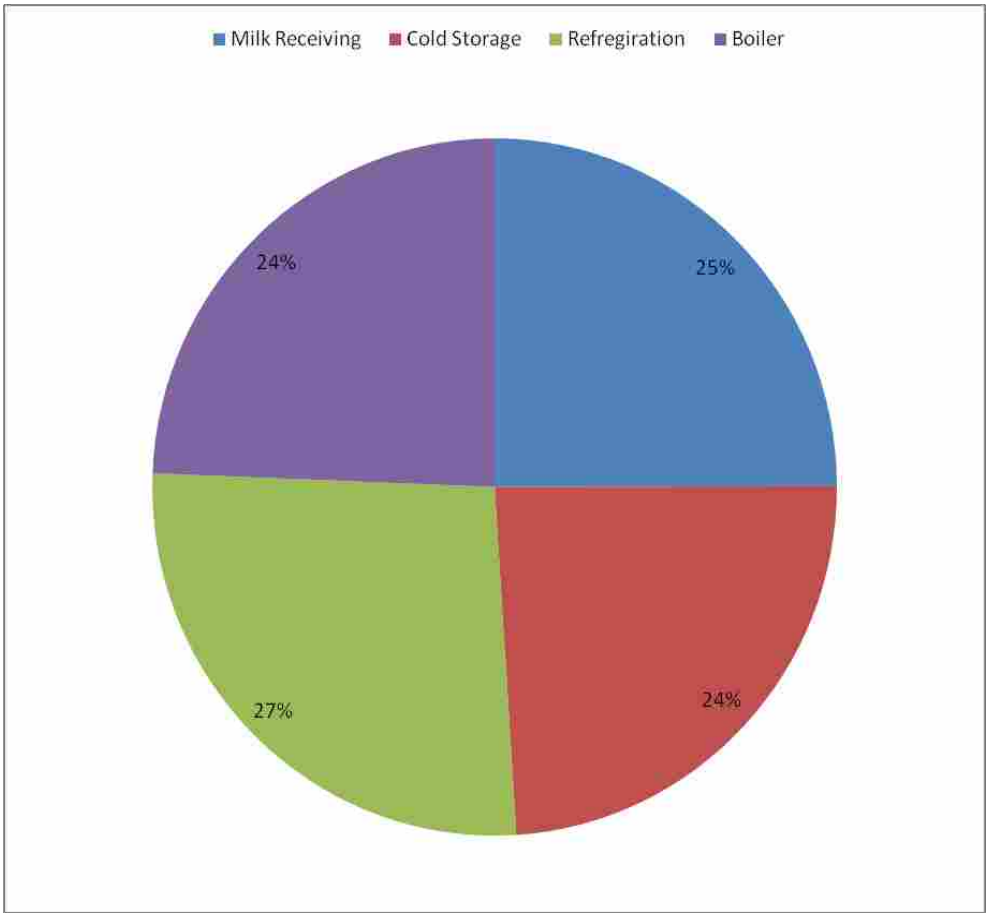
Statistical Analysis and Observations

Age of dairy workers in different sections

Section	Means	Angles
Milk Receiving	38.5	89.825016
Cold Storage	37.1	86.558651
Refrigeration	41.1	95.891121
Boiler	37.6	87.725210
Total	**154.3**	**360**

Angles of different sections are obtained by using formula -

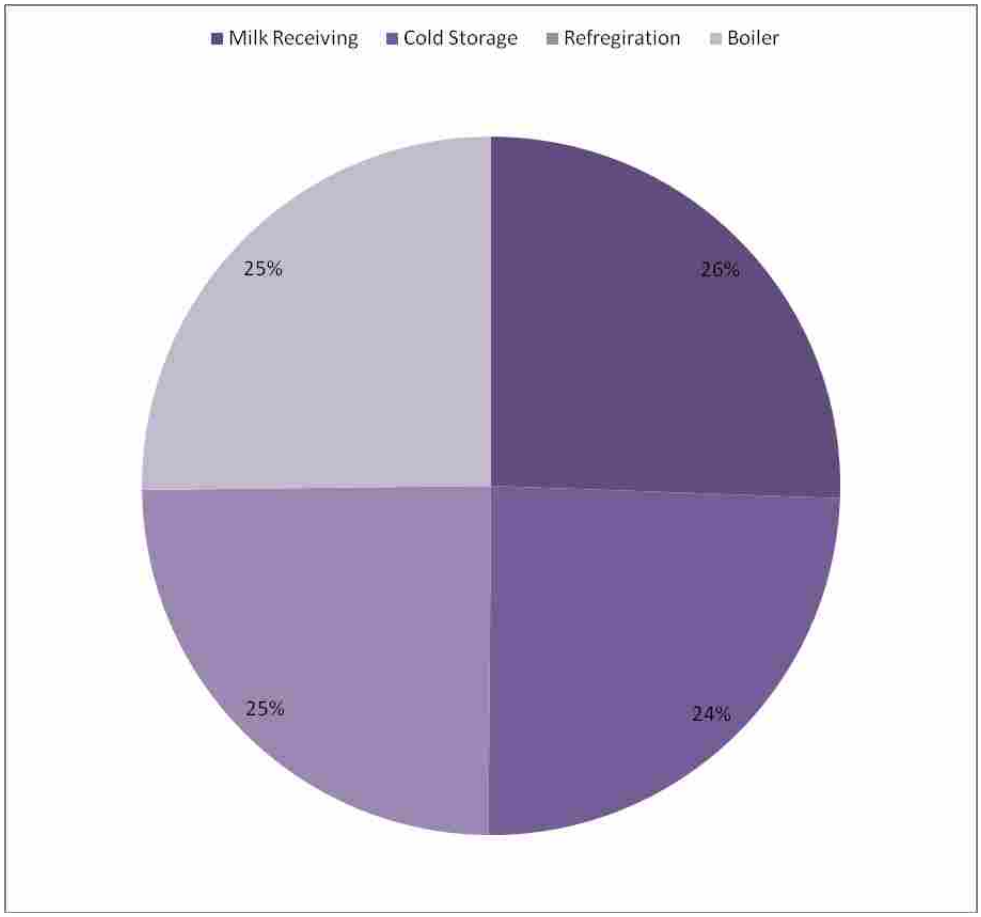
$$\text{Angle} = \frac{\text{Value of component}}{\text{Total value}} \times 360$$



Diag. 3.1 : Pie diagram shows the distribution of average age of the workers in 4 sections.

Height of dairy workers in different sections

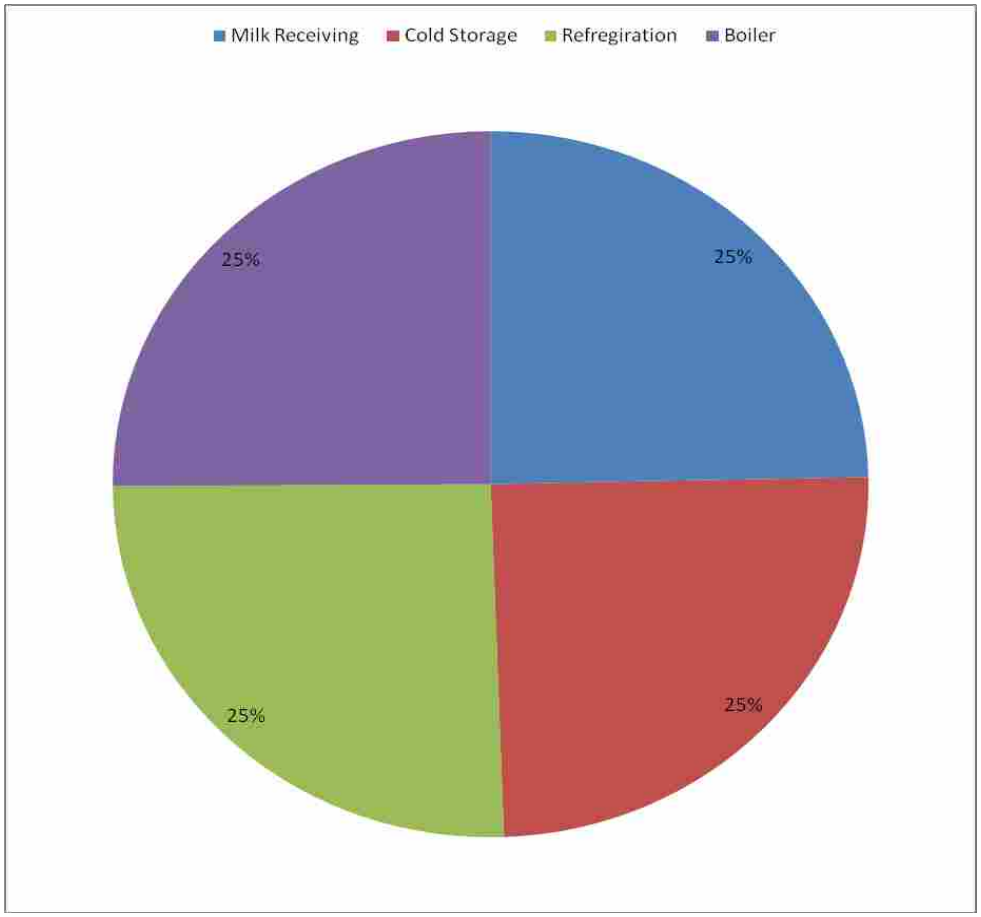
Section	Means	Angles
Milk Receiving	167.4	92.034208
Cold Storage	160.8	88.405620
Refrigeration	161.7	88.900427
Boiler	164.9	90.659743
Total	**654.8**	**360**



Diag. 3.2 : Pie diagram shows the distribution of average height of the workers in 4 sections

Weight of dairy workers in different sections

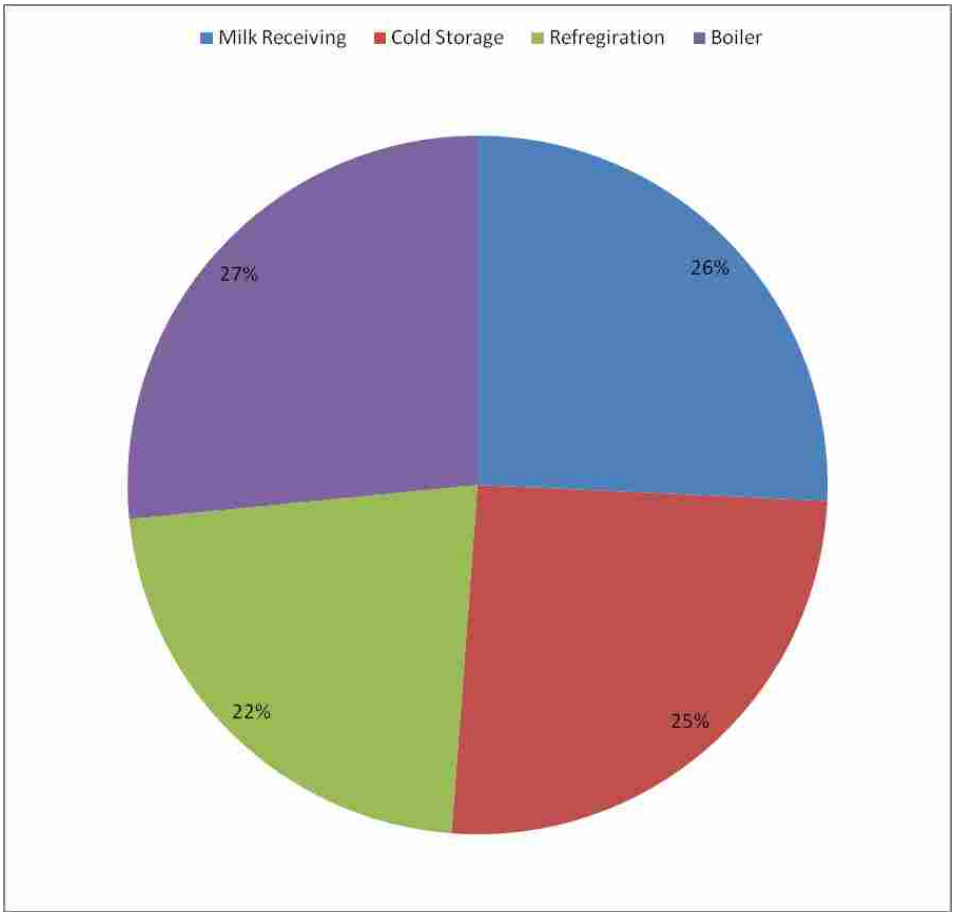
Section	Means	Angles
Milk Receiving	61.5	88.844301
Cold Storage	61.7	89.133226
Refrigeration	63.5	91.733547
Boiler	62.5	90.288924
Total	**249.2**	**360**



Diag. 3.3 : Pie diagram shows the distribution of average weight of the workers in 4 sections

Pulse Rate of dairy workers in different sections

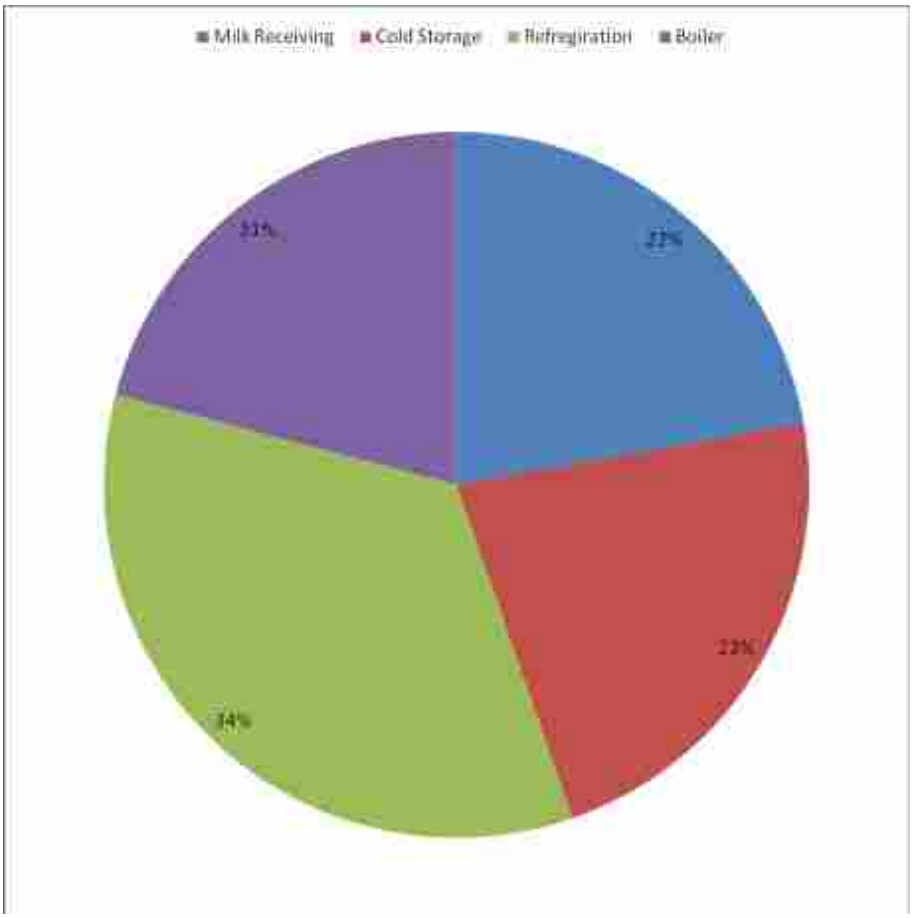
Section	Means	Angles
Milk Receiving	93.0	92.639734
Cold Storage	92.0	91.643608
Refrigeration	80.4	80.088544
Boiler	96.0	95.628112
Total	**361.4**	**360**



Diag. 3.4 : Pie diagram shows the distribution of average Pulse Rate of the workers in 4 sections

Physical Fitness of dairy workers in different sections

Section	Means	Angles
Milk Receiving	40.4	79.912087
Cold Storage	40.9	80.901098
Refrigeration	62.7	124.021978
Boiler	38.0	75.164835
Total	**182**	**360**



Diag. 3.5 : Pie diagram shows the distribution of average Physical Fitness of the workers in 4 sections.

Table No. 3.1 : Illumination level of Dairy workers in various Sections

Sr. No.	Name of Section	Illumination of Lux.
1	Milk Reception / Doc Section	400
2	Cold Storage / Cold Room	182.85
3	Boiler	157.40
4	Refrigeration	112.02

Table No. 3.2 : Noise level in various sections

Sr. No.	Name of Section	Noise dB
1	Milk Reception / Doc Section	120
2	Cold Storage / Cold Room	90
3	Boiler	100
4	Refrigeration	130

Table No. 3.3 : Temperature and Relative humidity of Dairy workers in various Sections

Sr. No.	Section	Temperature In ^{o}C	Relative Humidity
1	Milk Reception Section / Doc	38^{0}	32%
2	Cold Storage	-10^{0}	34%
3	Refrigeration	35^{0}	34%
4	Boiler	43^{0}	39%

Table 3.4 : Pulse Rate of Dairy workers in various sections

Section	Mean	S. D.	C. V.
Milk Receiving	93	4.58	4.92%
Cold Storage	92	4.0	4.35%
Refrigeration	80.4	10.89	13.54%
Boiler	96.0	4.89	5.09%

Mean, Standard Deviation and Coefficient of Variation (C.V.) are obtained by using following formulae.

$$\text{Mean} = \bar{X} = \frac{\sum_{i=1}^{n} X_i}{n}$$

$$\text{S.D.} = \sigma = \sqrt{\frac{\sum_{i=1}^{n} X_i^2}{n} - \bar{X}^2}$$

$$\text{C.V.} = \frac{\sigma}{\bar{X}} \times 100$$

The table 3.4 shows the mean, S. D. and C.V. of 10 workers each of Milk Receiving, Cold Storage, Refrigeration and Boiler sections.

The average pulse rate of Boiler section workers is the highest and is 96 / min where as for Refrigeration section workers it is lowest and is 80.4 / min.

Variations in pulse rate among the workers is more for Refrigeration section and it is very less in Cold storage section workers. *i.e.* the average pulse rate for Cold storage section workers is near about 92/min.

Table 3.5 : Systolic Blood Pressure of Dairy workers in various Sections

Section	**Mean mm/Hg**	**S. D.**	**C. V.**
Milk Receiving	127.0	7.81	6.15%
Cold Storage	125	6.71	5.37%
Refrigeration	138.5	7.76	5.6%
Boiler	130	7.75	5.96%

Table No. 3.5 represents the average Systolic blood pressure, standard deviation and C.V. of the workers in 4 sections.

The average Systolic blood pressure of Refrigeration section workers is high and is 138.5 mm/Hg with more variations and it is 125 mm/Hg for the Cold storage section which is the lowest among these 4 sections, with lesser variation in Systolic blood pressure of their section workers.

Table 3.6 : Diastolic Blood Pressure of Dairy workers in various Sections

Section	Mean mm/Hg	S. D.	C. V.
Milk Receiving	80	7.8	9.75%
Cold Storage	85	6.71	7.89%
Refrigeration	88	8.72	9.91%
Boiler	85	6.71	7.89%

Table 3.6 shows the average Diastolic Blood Pressure, S.D. and C.V. of 10 wokers in Milk Receiving, Cold Storage, Refrigeration and Boiler Section.

The mean Diastolic blood pressure of Refrigeration section workers is more with more variations among the 4 sections. Where as for Milk Receiving Section, it is normal with average 80 mm/Hg.

Table 3.7 : Horizontal Right Grip Strength of dairy workers in various Sections

Section	Mean	S. D.	C. V.
Milk Receiving	38.4	4.86	12.66%
Cold Storage	38.4	5.06	13.18%
Refrigeration	41.8	5.33	12.75%
Boiler	38.4	6.54	17.03%

Table 3.7 gives the mean, S. D. and C.V. of 10 workers each of 4 sections viz. Milk Reception, Cold Storage, Refrigeration, Boiler Section workers.

For Refrigeration Section worker the Horizontal Right Hand Grip Strength is more than other 3 sections. This grip strength is equal for remaining 3 sections but the variations are more for Boiler Section and variations among Milk Reception Section are less as compared to other section workers.

Table 3.8 : Horizontal Left Grip Strength of Dairy workers in various Sections

Section	Mean	S. D.	C. V.
Milk Receiving	36.1	5.48	15.18%
Cold Storage	37	5.04	13.62%
Refrigeration	39.5	5.75	14.55%
Boiler	35.9	7.45	20.75%

Table 3.8 represents the average, S.D. and C.V. of Milk Reception, Cold Storage, Refrigeration and Boiler Section workers.

The Horizontal Left Hand Grip Strength is highest for Refrigeration Section workers and it is 39.5 kgs. Where as it is lowest for Boiler Section and it is 35.9 kgs. with higher variations among 10 workers grip strength.

Table 3.9 : Vertical Right Hand Grip Strength of Dairy workers in various Sections

Section	Mean	S. D.	C. V.
Milk Receiving	36.8	6.42	17.45%
Cold Storage	36.5	4.82	13.2%
Refrigeration	39	4.88	12.51%
Boiler	37.9	6.24	16.46%

From Table 3.9, it is clear that the average Vertical Right Hand Grip Strength is high for Refrigeration Section workers and it is low for Cold Storage Section with low variations, which means this grip strength is almost 36.5 kgs for all the 10 workers in Cold Storage Section.

Table 3.10 : Vertical Left Hand Grip Strength of Dairy workers in various Sections

Section	Mean	S. D.	C. V.
Milk Receiving	36	6.31	17.53%
Cold Storage	34.9	3.92	11.23%
Refrigeration	37.8	5.65	14.94%
Boiler	36.4	6.86	18.85%

From Table 3.10, represent the average, S.D. and C.V. of 4 sections each of 10 workers. The Refrigeration Section workers have the highest Vertical Left Hand Grip Strength and Cold Storage Section have the lowest Vertical Left Hand Grip Strength with lesser variations. For the Boiler Section, this Grip Strength is 36.4 kgs has more variations *i.e.* this section workers are not having equal strengths as 36.4 kgs.

Table 3. 11 : Respiratory Rate

Section	Mean	S. D.	C. V.
Milk Receiving	18.4	0.8	4.35%
Cold Storage	18	0.0	0.0%
Refrigeration	17	0	0.0%
Boiler	18.3	0.46	2.51%

The Average and S.D. Respiratory Rates of 4 section workers are shown in the table No. 3.11.

The Average Respiratory Rate is more for Milk Reception Section workers and it is 18.4 mm/Hg and also it has more variations among all 4 section workers.

The Average Respiratory Rate is less for Refrigeration Section wokers and it is 17 mm/Hg and the variations are zero. It means all the 10 workers in this section have the same Respiratory Rate 17 mm/Hg.

Table 3.12 : Peak Expiratory Flow Rate (PEFR)

Section	Mean	S. D.	C. V.
Milk Receiving	404.5	112.57	27.83%
Cold Storage	423.5	99.85	23.58%
Refrigeration	430.5	63.97	14.85%
Boiler	396.0	83.81	21.16%

The table no. 3.12 shows average, S.D. and C.V. PEFR of Milk Reception, Cold Storage, Refrigeration and Boiler Section workers.

The highest PEFR is 430.5 L/min for the Refrigeration Section workers but has low variations. Where as for Boiler Section workers the average PEFR is 396 L/min. which is the lowest among all the 4 section workers.

CHAPTER IV

Discussion and Recommendations

Work place Environment and Occupational Stress

Environment of the organization influences the productivity and efficiency of the workers. The work environment should have comfortable temperature, must be free from dust, noise, fumes, undesirable odours. One should protect the workers against any health hazards and maintain a highest possible degree of physical and mental well being of workers.

Stress at work place can be caused by chemical, physical, biological and social factors. It is interesting to study the work place environment and occupational stress in dairy industry. It has been observed that the dairy plant workers are exposed to various occupational stresses. Severe prolonged stress produce severe physical, mental stress which affect work efficiency. The dairy workers suffer from various physiological stress factors like heat, cold, humidity, noise and effect of ammonia gas. The study focuses on the work environment occupational stress and monitoring of work place environment. The work place occupational stress vary from section to section.

Recent research studies have established the link between psychological and physical factors. Brod (1971) observes high blood pressure is another widespread disease in which stress plays a critical role. Studies carried out by Randolf (1996) show that 85% of all physical illness are all stress related.

In Gokul dairy plant though the management works for the industrial workers safety and increase the productivity but some aspects are neglected unknowingly.

Pie diagram 3.2 shows that the average heights for all the 4 sections are nearly equal similarly the average weights in pie diagram 3.3 of 4 sections are also nearly same. The average age shown in pie diagram 3.1 of Refrigeration Section workers is little more than other section workers. Similarly, for Refrigeration Section the average pulse rate is higher than that of Milk Receiving, Cold Storage and Boiler Section workers as shown in pie diagram 3.4. Overall the average age, height, weight, pulse rate and physical fitness for Milk Receiving, Cold Storage and Boiler Section workers is nearly equal.

Proper illumination has become one of the important aspects of occupational hygiene. The Factories Act 1948 sub section (1) of section 17; mentions “In every part of a factory

where workers are working or passing, there shall be provided and maintained sufficient and suitable lighting" Factories Act 1948 under section 17, gives power to the state government to lay down the rules regarding illumination at work place. According to the Maharashtra Factories rules 1963 the minimum intensity of illumination for different areas and work rooms range from 20 to 1000 lux.

High intensity light produces glare and creates strain on eye. Inadequate illumination affects the performance, colour, direction, brightness, contrast, diffusion, uniformity. Adequate illumination improves quality, quantity and enhanced productivity. Rasyid and Siswanto (1987) have observed the light intensity from 100 lux to 500 lux resulted in the increase of 9.5 percent hourly output. Poor light degrades visual and sensomotor performance. Kroemer (1994) has mentioned in his research work that the visual environment should be well lit, clean and uncluttered allowing good depth perception and discrimination of visual details.

Illumination in the Milk Reception Section / Doc was 400 lux. This is below the set standards. It has been observed badly lit work atmosphere affected the workers.

Heat

Heat is the common industrial hazard. It is necessary to maintain the thermal balance. If the thermal balance is not maintained the workers suffer from heat stress. Heat causes mental and physical fatigue and makes the worker prone to accidents. Dehydration, muscle cramps, nausea, headache, clammy skin, heavy sweating, shortness of breath, rapid pulse are some of the symptoms of heat stress. The workers working in boiler section showed the symptoms of stress. The average pulse rate of boiler section workers was 96 and average SBP was 130 and DBP was 85. Which are higher indicating the work place stress. They have poor grip strength. The respiratory rate 18.3 and PEFR was 396. All these indicate the stress resulting in variation in the Pulse rate, average of the respiratory rate and the PEFR.

The workers working in boiler section suffer due to heat. Weiner and Hutchinson (1945) have mentioned in research work that there is a significant decline in the performance of workers in conditions of stress. Han Cook (1981) in his investigation concluded that heat stress influence reaction of time and mental work. Factories act under section 13 lays preconditions for factories regarding ventilation and temperature. According to sub section (i) (b), "effective and suitable provision should be made in every factory for securing and

maintaining in every work room, such a temperature as will secure to workers these in reasonable conditions of comfort and prevent injury to health and any particular walls and roofs shall be of such material and designed to control the temperature and protect the workers by insulating the hot parts or by other means."

Cold

Cold is a major health hazard. The work places like cold storage and cold rooms have artificial cold environment. Working in artificial cold environment can be stressful to the workers. Chen et. al (1991) studied the relationship between cold exposure and musculoskeletal complaints in the form of low back pain, knee pain and shoulder pain. Low temperature has direct impact on the body temperature. In asthametic patients cold is known to induce broncho constriction. Study carried by Tochihara (2005) on work of in artificial cold environments showed cold stress and decrease in performance and efficiency in the cold storage workers and increased risk of both hypothermia and accidents for the night shift and cold store workers. Dovrat et. al (2007) in their investigation carried out on cold exposure and low back pain in cold store workers in Israel have observed that workers in cold storage are at greater risk of lower back pain.

The dairy workers working in Gokul dairy plants are exposed to the hazards of cold. There are six cold storage rooms having the temperature varying from 0^0C to -4^0C and -18^0C to -20^0C. The worker has to work in cold storage room for longer duration. The worker enters the cold storage room frequently for stacking the finished milk products and unloading. The cold storage workers showed lower grip strength, lower physical fitness and high pulse rate, higher B.P. indicative of cold stress. Dairy management provides overcoats to the workers while working in the cold rooms. But the thermal costumes should be provided to workers to reduce the cold stress.

Noise

Noise is one of the occupational stress. It affects the efficiency and health of diary workers . Experiments have shown high level noise cause cardio-vascular diseases. The noise level ranging between 130-140 dB is considered highly injurious, 90 db – 120 db injurious, 80 dB is risky, 70 dB speech masking, 50 dB can be irritating. No exposure is permissible beyond 115 dB, 90 dB noise level is permissible for 8 hours exposure per day, while 92 dB for 6 hours, 95 dB for 4 hours, 100 dB for 2 hours, 110 dB for ½ hour and 115 dB for ¼

hour is permissible. Prolonged exposure to the noise can damage hearing, cause hypertension, tachycardia, anxiety, insomnia and neurosis. According to Harell (2006) “Noise is an unwanted sound which increases fatigue under some industrial conditions it causes deafness.” Noise produces physiological effects on the body. Talbott et. al (1985) in their research report mention the relationship between severe noise and the hearing loss, high blood pressure. Excessive noise can temporarily rise the rate of breathing heart rate. It has been observed that the excessive noise cause nervous irritability and stress. It has been observed that workers of the Milk Reception Section / Doc are exposed to high level noise above 120 dB. The collected milk from the milk co-operative societies is brought to Doc/Milk Reception Section. Here, the workers unload the milk from cans. The banging and rolling of the empty cans creates lot of noise. The sound of the compressor in Refrigeration Section, creates 130 dB, high intensity noise produced in boiler section 180 dB are beyond the prescribed norms. The workers from Doc, Refrigeration and Boiler Section are affected by the noise stress. They show high pulse rate and high blood pressure levels. The acceptable noise level recommended by the bureau of Indian standards in the industrial area is between 45 dB to 60 dB and 75 dB is the recommended limit by W.H.O.

Ergonomical work place stress

Working in dairy plant presents a variety of ergonomic hazards. Four key physical risk factors associated with ergonomic hazards in the work place are identified by the Ergonomic and medical experts. Awkward postures, biomechanical stresses, repetition and force repetitive forceful or prolonged exertions of the hands, frequent or heavy lifting, pushing, pulling or carrying heavy objects, prolonged awkward postures and vibrations contribute to the musculoskeletal disorders. Lifting of the heavy objects without regard to ergonomics rules leads to weakness in the elasticity of the deep veins resulting in the varicose veins. Awkward postures, unnatural postures, sudden and unexpected motions cause lower back pain. Working in static position for a longer duration affects the spinal segments, shoulder and creates occupational fatigue.

The workers working in a dairy plant are exposed to ergonomic hazards. The workers working in milk reception section / Doc have to do the loading and unloading of the milk cans. They lift heavy milk cans and place them on the conveyor belt. They have to bend in awkward position while washing the cans. All these activities have resulted in the musculoskeletal disorders. Workers from this section suffer from musculoskeletal disorder. It

has been observed that the workers from this section suffer from lower back pain, shoulder pain, upper back pain, stiff neck, slip disc and other musculoskeletal related disorders.

Manual material handling can create problems for skeletal system. Improper lifting technique, excessive weight, awkward box sizes can cause injuries. Lifting stresses induces back joint pain, pain in tendons and in the upper and lower extremities include the structures of the hands wrists, arms and shoulders. If a person stands or bends in wrong posture for longer duration that may result in musculoskeletal disorders. Bending strains the back ligaments. The workers from milk reception section / Doc lift the loaded milk cans. The occupational back injuries are caused by the lifting risk factors like load, force, repetition posture. As per the NIOSH (1981) lifting guidelines 'A lifting task is considered to be the act of manually grasping and raising an object of definable size without mechanical aids.' Snook (1983) in his study has observed that musculoskeletal stresses and strains though develop slowly, they are the major cause of ill health, absenteeism and partial disability. He has reported that ergonomic design of the job can eliminate up to one third of compensable low back pain in industry. Low back pain is believed to be the commonest affecting illness over half of the working population. WHO (1985) observed the control of work related musculoskeltal disorders can best be done through improvement in work design, tools, equipment and work methods.

Working period is called 'work cycle' and during this period physiological functions like heart rate, blood pressure, cardiac output, respiration, pulmonary ventilation, oxygen uptake change. Accelerated pulse rate means the body is working under heavy load. The blood pressure of an individual reflects his physical capabilities and health condition. Rise or falls in B.P. can cause medical complications. The refrigeration section workers have the highest average of SBP and DBP. The other section workers inclined towards higher level average of SBP 138.5 mm/Hg and DBP 88 mm/Hg. Exertion, heat, cold, noise are some of the stress factors affecting health of the workers.

Physical fitness is one of the vital aspects of productivity and efficiency. The physical fitness of the workers prevents work injury. Physical fitness consists of the factors like cardiorespiratory endurance, lifting capacity, upper and lower strength, grip strength and perceived work ability. Aerobic capacity is low in the person with low physical fitness. Physically fit persons can tolerate heat stress and other occupational stress.

Handgrip strength indicates forearm muscle strength. Handgrip strength is important for carrying out tasks like lifting, catching, throwing the objects. The dairy workers working in the four sections have shown the poor to very poor handgrip strength indicating poor physical fitness.

The respiratory system plays a very important role in human existence. Individuals work performance is dependent on cardio respiratory system. Efficient functioning of the respiratory and circulatory systems play an important role in supply of oxygen and to eliminate excess carbon-di-oxide and to maintain the acid balance of the body. Working in polluted environment causes damage to the lung resulting in the lowering of lung functioning of the workers.

PEFR indicates the effects of inhalation of dust. It provides information about the lung functions and also provides clue in detection of suspected cases of occupational diseases. It also helps to assess respiratory disorders caused due to inhalation of dust and other environment pollutants. It is observed that boiler section workers have the lowest average PEFR 396 and the workers from the assessed sections were exposed to the occupational stress like humidity, heat, dust, ammonia gas, cold which resulted in the lowering of lung capacity.

Recommendations

Work place Environment Monitoring

Environment monitoring of the work place should deal with occupational health hazards, workers safety and health. Monitoring of work place should focus on identification of health hazard its evaluation and control. This will help to create safe work place and work environment, promote workers health and increase the productivity. Gardell (1980) emphasized that action is needed at individual level, system level and organizational level for environmental monitoring. Environmental monitoring must take place in collaboration. There should be feed back and continuous evaluation of the work place. Awareness must be increased among the workers so that they can identify and change the unhealthy working conditions. Kagan and Levi (1974) have observed that management must be able to identify the risk factors in the working environment and their negative health effects, continuous monitoring is necessary including occupational environment and health statistics. Data gathering should be done on a holistic view of the employee and his working life including physical, chemical, environmental, psychological and socio-economic factors. Preventive measures are very important for workers health, competence and well being. Environment monitoring should be designed and implemented by accredited professionals as a part of an occupational health and safety monitoring program.

Work environment monitoring can be done by following the routine given below.

- Conduct regular walk around inspection.
- Investigate incidents related to stress.
- Review health, absenteeism.
- Assist the committee on problems related to stress.
- Recommend changes that might reduce stress.
- Hold educational sessions on job stress.
- Should have active association with personnel at research and academic institutions developing and carrying out scientific studies on occupational stress.

WHO (1988) has listed three basic things in the strategy for work place health promotion. The planning should be feasible, there should be continuous monitoring and evaluation of the implemented programme and health promotion activities should be seen as voluntary not mandatory process. Good house keeping, training, effective maintenance of the

machinery and safety device are the vital factors in improving and working environment in the dairy plant. Prevention and elimination of the stress element is paramount importance.

Occupation stresses and Hazards in the selected sections of the dairy

Name of the section	Nature of work environment	Occupational stress
Milk Reception / Doc	• Lifting milk cans • Unloading • Carrying • Lifting	• Noise • Musculoskeletal disorders • Lower backache • Stiffness of neck, slip disc
Cold Storage	• Low temperature	• Cold stress • Numbness • stiffness
Refrigeration	• Ammonia gas • Low temperature	• Cold stress • Chemical hazard • Cough • Irritation of eye
Boiler	• Heat • Humidity • Steam • High Temperature	• Heat stress • Heat cramps • Sweating

Environmental and ergonomical stresses were found to be prevalent in the dairy industry. These stresses can be minimized by various measures. The stress faced by the workers from dairy industry is quiet varied.

Illumination

- Electrical layout should be designed scientifically.
- Lamps and luminaries should be cleaned regularly.
- Light installation should be so designed that it reduces completely or prefereably eliminates glare.

Noise

- Earplugs and earmuffs should be used.
- Regular hearing test should be conducted and noise exposure analysis should be done.
- There should be education about harmful aspects of noise.
- There is need for hearing loss prevention programme. This should include noise monitoring, training, efforts to reduce noise and use of hearing protectors.
- There should be strict check on industries for noise control while issuing and renewing of license.

Heat

- Heat load should be reduced by using better ventilation and screening.
- Workers should be provided with the information about risk, prevention symptoms, the importance of monitoring oneself and the co-workers about the treatment and the personal protective equipments.

Cold

Workers working in cold rooms, cold storage are prone to cold. The following action should be taken

- Workers should be trained to recognize the signs of hypothermia and use protective clothing and equipment.
- Workers should be provided with thermal wares.

Ergonomic stress

The workers from Doc/milk reception section suffer from ergonomic stress due lifting, carrying, bending, pushing and pulling of heavy milk cans. To monitor the working NIOSH (1997) has recommended five steps that the employer should follow.

- Provide education and training to all the employees to identify the signs and symptoms of ergonomically related injuries and illness.

- Encourage employees to report the early symptoms of ergonomically related injuries.
- Employer should modify the work process that causes ergonomic risks.
- Hazard survey should be carried out using hazard inventory to evaluate and prevent possible hazard at work place.
- OSHA (1990), NIOSH (1997) guidelines automation and mechanization are mentioned as engineering solutions to reduce ergonomic hazards.

To prevent and eliminate occupation stress monitoring work place environment is essential. Under this work place environment monitoring periodic work place survey, establishment and monitoring of health surveillance evaluation, organization of ergonomic training programs are necessary.

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UNIVERSITY GRANTS COMMISSION
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PROFORMA FOR SUBMISSION OF INFORMATION AT THE TIME OF SENDING THE FINAL REPORT OF THE WORK DONE ON THE PROJECT

1. **NAME AND ADDRESS OF THE PRINCIPAL INVESTIGATOR :**
   Dr. Mrs. Majiri Ajit More, New Shahupuri, Kolhapur
2. **NAME AND ADDRESS OF THE INSTITUTION :**
   Gopal Krishna Gokhale College, Kolhapur
3. **UGC APPROVAL NO. AND DATE :** F-47-020/12(WRO) dated 27.08.2013
4. **DATE OF IMPLEMENTATION :** 01.09.2013
5. **TENURE OF THE PROJECT :** 30.08.2015
6. **TOTAL GRANT ALLOCATED :** 1,00,000/-
7. **TOTAL GRANT RECEIVED :** 80,000/-
8. **FINAL EXPENDITURE :** 1,19,903/-
9. **TITLE OF THE PROJECT :**
   Environmental Monitoring and Occupational Stresses in Dairy Industry
10. **OBJECTIVES OF THE PROJECT :**
    - All potential health hazards in terms of stress and strain.
    - The existence of occupational stresses.
    - Suggest suitable measures to reduce stress.
    - Propose the ways to monitor work place environment of the dairy industry.
    - Suggestion to improve workplace safety and promote highest degree of physical and mental well being. The dairy industry worker which will improve efficiency and productivity of the dairy worker.
11. **WHETHER OBJECTIVES WERE ACHIEVED :**

Occupational health is concerned with identifying, evaluating and controlling physical, chemical and biological hazard in work place. Primary aim of occupational hygiene is elimination of occupational diseases. WHO (1988) has listed three basic things in the strategy for work place health promotion. The planning should be feasible, there should be continuous monitoring and evaluation of the implemented programme and health promotion activities should be seen as voluntary not mandatory process. Rosen (1984) lists the advantages of health promotion programmes. Programmes increase

productivity, reduce labour turnover, reduce workers medical costs, compensation of insurance and increase employee satisfaction.

Good house keeping, training, effective maintenance of the machinery and safety devices are the vital factors in improving the working environment in the dairy plant. It would have telling effect on the safety and productivity. Prevention and elimination of the hazards is of paramount importance. Awareness among the work force and the occupational health development should ensure the availability, accessibility and affordability of primary occupational health service will ensure the safety, welfare and well-being of the dairy worker. While working the worker interacts with colleagues, the work, work place, environment, which is physical, chemical and biological. Research is an important tool for the development of occupational health, providing scientific basis for policy making, priority setting, problem solving, professional training and evaluation. The study carried out and its finding would help the dairy management to become aware of the working condition and occupational hazards and stress faced by the dairy plant workers of Kolhapur Dudh Utpadak Sangh Ltd. and implement the programmes that would work for the hazard free work environment, safety and welfare of dairy workers.

2. ACHIVEMENT FROM THE PROJECT :

The dairy industry is one of the largest industries in Western Maharashtra. We observed manifestation of occupational hazards. The occupational hazards in the form of excess Noise, Stress, Dust, Inadequate Illumination, Heat Stress, Cold Stress, Night Shifts, Accidents, Exposure to chemical. Ergonomical hazards like Awkward Posture, Excessive Workload were encountered by the workers from the dairy industry.

After the assessment of Environmental factors and Ergonomical hazards various stresses were found to be prevalent in the dairy industry. These stresses can be minimized by various safety measures.

The stresses faced by the workers from dairy industry are quiet varied. The working environment influences the work performance of the workers. The dairy industry encounters occupational hazards in the form of physical agents *i.e.* Environmental factors, Biological factors and Chemical factors. These various stress factors affect the workers health and predominently the work capacity and production in dairy industry. The Management Council of the Dairy Industry has neglected these occupational hazards which indirectly affect the overall production of the dairy industry.

'A stitch in time saves seven'. 'An ounce of prevention is worth a pound'. Occupational health services and the dairy industries have forgotten this. It is necessary to change the working conditions and bring improvements. Mechanisms to change the environmental conditions should be brought about. Workers themselves must play a vital role in identifying hazards at work place. There is need for legislation and research to prevent occupational hazards. Action is needed at individual level, systems level and organizational level to prevent hazards. Technological design, development of strategies and government interventions facilitate the prevention of the occupational hazards.

13. SUMMARY OF THE FINDINGS :

Dairy industry is one of the oldest and largest industries in the World. In India, large number of people are engaged in the dairy industry. Kolhapur Dudh Utpadak Sangh Ltd. Operates dairy plant at Gokul Shirgaon Industrial Estate. It is famous as 'Gokul Dairy' and the plant consists of various sections *i.e.* Milk Reception/Doc, Milk processing section, milk pouching section, production and packing section, cold storage and engineering and maintenance section. Engineering and maintenance section consists of boiler section, mechanical section, refrigeration and effluent treatment plant. The study carried out at this dairy plant showed the occupational hazards and stress caused due to noise, vibration, inadequate illumination, heat, cold, dust, chemical hazards like exposure to ammonia gas, shift work, freak accidents and ergonomic hazards caused due to wrong body posture during work, faulty work place design. The present research intends to evaluate the occupational stresses and hazards in dairy plant workers of Gokul Dairy.

The various statistical analysis have been interpreted taking the office workers as standard and comparing the workers from various sections. The average heights and weight for all the sections are nearly equal. The average age of Refrigeration section worker is little more than other section workers. Overall the average age, height, weight, pulse rate and physical fitness for Milk Receiving, Cold Storage and Boiler Section workers is nearly equal. Illumination in the Milk Reception Section/Doc was 400 lux. which is below the set standards and it affects the work atmosphere. Heat is the common industrial hazard which causes mental and physical fatigue and makes the worker prone to accidents as they suffer from heat stress. The worker working in boiler section showed the symptoms of stress. The average pulse rate and average SBP and DBP of boiler section worker was higher indicating the work place stress. The work places like cold storage and cold rooms have artificial cold environment. There are six cold storage rooms having the temperature

varying from 0°C to –4°C and –18°C to –20°C. So, the cold storage workers showed lower grip strength, lower physical fitness and high pulse rate, higher B.P. indicative of cold stress. Experiments have shown high level noise cause cardio-vascular diseases. It has been observed that the workers of the milk reception section / Doc are exposed to high level noise above 120 dB. The workers from Doc, Refrigeration and Boiler section are affected by the noise stress and they show high pulse rate and high blood pressure levels. The workers working in a dairy plant are exposed to ergonomic hazards. Such as lifting, bending, musculoskeletal disorders, back pain, stiff neck, etc. PEFR provides information about the lung functions and also helps to assess respiratory disorders caused due to inhalation of dust and other environmental pollutants. It is observed that boiler section workers have the lowest average PEFR 396 who exposed to the occupational stress like humidity, heat, dust, ammonia gas, cold which resulted in the lowering of lung capacity.

14. CONTRIBUTION TO THE SOCIETY :

Recent research studies have established the link between psychological and physical factors. Environmental monitoring of the work place should deal with occupational health hazard and deal with workers safety and health. This would result in creation of safe work and working environments, promotion of the health of personnel and increase in the work capacity of workers, promote proper utilization of human resource and increase the productivity. Awareness must be increased among the workers so that they can identify and change the unhealthy working conditions. Technology, work organization, work time and payment systems should be designed in consideration with workers safety and remove negative psychological effect at work place.

15. **WHETHER ANY PH.D. ENROLLED / PRODUCED :** NIL

OUT OF THE PROJECT

16. **NO. OF PUBLICATIONS OUT OF THE PROJECT :** 2

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OCCUPATIONAL STRESS AND IMPACT ON HEALTH STATUS OF DAIRY INDUSTRY WORKERS

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Abstract:
Environment of organization influences the productivity and efficiency of the workers. The work environment should have comfortable temperature,must be free from dust ,noice fumes,undesirable odour.One should protect the workers against any health hazards and maintain a highest possible degree of physical and mental well being of workers.Stress at work place can be caused by chemical, physical,biological and social factors.It is intressting to study the work place environment and occupational stress in dairy industry.It has been observed that the dairy plant workers are exposed to various occupational stresses.

Keywords: Occupational, Stresses, Dairy, Milk reception.

Introduction:

Industrial occupational hazards, stress, lack of safety measures, lack of healthy work place environment and welfare schemes are affecting the safety and health of the industrial workers. Dairy industry is one of the oldest and largest industries in the world. It is the backbone of the nation's economy. In India large numbers of people are engaged in the dairy industry. Maharashtra is one of the leading states in dairy industry and has provided employment to large number of people.

Kolhapur Dudh Utpadak Sangh Ltd. operates dairy plant at Gokul Shirgaon Industrial estate. It is famous as Gokul Dairy and the plant consists of various sections i. e. milk Reception section/ Doc, milk processing section, milk pouching section, production and packing section, cold storage and Engineering and maintenance section. Engineering and maintenance section consists of boiler section, mechanical section, refrigeration and effluent treatment plant. The study carried out at this dairy plant showed the occupational hazards and stress caused due to noise, vibration, inadequate illumination, heat, cold, dust, chemical hazards like exposure to ammonia gas, shift work, freak accidents and ergonomic hazards caused due to wrong body postures during work, faulty work place design. A healthy and scientifically designed work place and work conditions increase the efficiency of workers and productivity of the industry. The present research intends to evaluate the occupational stresses and hazards in dairy plant workers of Gokul dairy. A systematic, scientific methodological study was carried out to achieve perfection and authenticity in the research work.

Materials and Methods:

The examination of workers in various sections of dairy was performed using a specially developed questionnaire that included group of questions related to the characteristics of the interrogated employee. Such as (Name, age, sex, employment time, weekly working days, working hours, cumulative exposures, working area in sq. mt., habitual practices like tobacco chewing, cigarette smoking). The other set of examinations were carried to access the physical and physiological status of the workers which included blood pressure, lung function test, haematological profile, step test etc. 100 workers were administered the tests. The analysis of data was done using statistical tools of methods. As per the sample size student's t - test was applied to assess and analyze the data which would help in authentic interpretation and conclusion. The calculations of student t – statistic have been done by the statistical software systat.

Observations:

The various statistical analysis have been interpreted taking the office workers as standard and comparing the workers from various sections with the office section workers.

$$H_0 : \mu_1 = \mu_2$$

V / S

$$H_1 : \mu_1 > \mu_2$$

H_0 = There is no significant difference between average PEFR L/min of
office workers and other section workers.

H_1 = The average PEFR L/min of office workers is greater than other
section workers.

Since, $t_{cal} > t_{table}$ for all section workers except Mechanical and Godown, hence H_o is rejected for these groups. Thus average PEFR is

1) Significantly lesser for all the section workers than that of Office section workers.
2) For Mechanical and Godown Section workers PEFR is almost equal to the office section workers. Refer table number1.

$$H_0 : \mu_1 = \mu_2$$

V / S

$$H_1 : \mu_1 < \mu_2$$

H_0 = There is no significant difference between average Neutrophil % of
office workers and other section workers.

H_1 = The average Neutrophil % of office workers is less than other
section workers.

Since, $t_{cal} < t_{table}$ for Doc. Processing, Product A, Product B, Coldstore and Boiler group. Hence we reject Ho at 5% L.S. *i.e.* the average % of Neutrophil for all these groups is more than that of office group and for Packing, Mechanical, Refrigeration and Godown section it is nearly equal to office section workers (Refer table number 1).

The Bar diagram given in Figure 1 represents the average Physical fitness score of the workers working in different sections of the dairy. Figures shown are the average Physical fitness score of the workers. The workers in office section have the highest average Physical fitness score which is 72.56 and the workers in boiler section have the lowest average Physical fitness score is 38.

The product A section represents Butter, Ghee and Powder sections and Product B section represents Shrikhand, Paneer, Lassi and Curd sections (Refer figure 1).

Discussion:

Work place environment and physiological profile of Dairy industry workers has been worked out and expressed in the graphical and tabular form. Work place environment and working conditions have a very vital impact on efficiency, morale and industrial condition. Environment of the organization has considerable influence on the efficiency of the workers. A healthy work place is an environment where health risks are recognized and controlled if they cannot be removed. In healthy work place, the work is designated to be compatible with people's health needs and limitations. The work area should have ample space for free movement and vision. There should be comfort in temperature, humidity, ventilation, clean air and free from dust, fumes and undesirable odours. The illumination should be without glare. Noise and vibration should be reduced.

The constitution has made special references to working conditions in the Directive principles of state policy. The relevant provisions in the constitution are "the state shall in particular direct in policy towards securing the health and strength of workers, men and strength of workers, men and women and the tender age children are not abused and that citizens are forced by economic necessity to enter vocations unsuited to their age or strength".(Indian constitution Article 39)

"The State shall make provision for securing just and human conditions of work and for maternity relief". (Indian Constitution Article 42)

The occupational health consists of measures for

1) Protecting the workers against any health hazards, arising out of their work place.
2) To take care of workers physical and mental adjustments.
3) Maintenance of highest possible degree of physical and mental wellbeing of workers.

Dairy industry is one of the oldest occupations of the world. It is interesting to study the work place environment, work place hazards and stresses in dairy plant workers. It has been observed that the Dairy plant workers are exposed to various occupational hazards. The work place hazards vary from section to section. The workers suffer from physiological stress factors like heat, cold, humidity dust and chemical factors like gases particularly the effect of ammonia gas. Etilogical agents like fungi and bacterial pressure. Shift work and the probable accidents are the risk factors which could be traced in the dairy industry. The awkward position while carrying out the work have potential to cause musculoskeletal disorders.

The study concentrates on the various work place hazards and stresses in dairy plant workers of Gokul Dairy plant at Gokul Shirgaon in Kolhapur. Ten workers from each section were randomly selected and administered various tests to evaluate the stress factors. Ergonomic survey of the various sections have revealed the physical, chemical and biological, musculoskeletal related problems causing potential hazards and stress factors.

Working in Dairy plant presents a variety of ergonomic hazards. The generic risk factors for musculoskeletal disorders are grouped in an operational way that is useful in explaining the work relatedness of musculoskeletal disorders that has biological possibility and has a strong connection with work place environment. Four key physical risk factors associated with ergonomic hazards in the work place are identified by the Ergonomic and medical experts. They are awkward postures, biomechanical stresses, repetition and force. Repetitive forceful or prolonged exertions of the hands, frequent or heavy lifting, pushing, pulling or carrying heavy objects, prolonged awkward postures and vibration contribute to the musculoskeletal disorders. Working conditions that combine risk factors will increase the risk of musculoskeletal disorders. Lifting of heavy objects without regard to ergonomic rules leads to weakness in the elasticity of the deep veins resulting in varicose veins. Awkward postures, unnatural postures, sudden and unexpected motions cause lower back pain. Working in static position for a long time adversely affects the spinal segments and shoulders and occupational fatigue.

Dust was another occupational hazard faced by the dairy plant workers. In the investigation carried out it was observed that the workers working in milk powder production section were exposed to milk powder dust. The Aggarwal S. P. and Agarwal M. K. (7994) have studied the **upfact** of dust pollution. The studies have shown that the workers showed significantly lower peak expiratory flow rate 470 lit/min. They showed the symptoms of wheezing, breathlessness. The workers working in Product A section showed the erythrocyte sedimentation rate at 14.1mm/hrs. Which was the highest among all the sections? The normal values of ESR by Westergren's method in males are 3 to 7 mm in one hour. Increase in erythrocyte sedimentation rate suggests the chronicity of respiratory impairment. When there is tissue break down or entry of foreign protein into the blood erythrocyte sedimentation rate increases neutrophil % is also increased which leads to respiratory impairment.

The statistical analysis of the physical fitness of the dairy plant workers from the various sections shows that the workers working in the office section have the highest average of physical fitness indicate the prevalence of hazards and stress free working environment. Boiler workers have the lowest average of physical fitness. Doc, Cold storage workers show an average physical fitness nearer to that of the workers working in cold storage section. The workers working in processing section have the lower average of physical fitness. The occupational hazards like cold, in cold storage section and heat in boiler section have the telling effect on the physical fitness of the workers from these sections. The workers from Doc are exposed to the occupational hazards like noise, dust and ergonomic hazards like lifting, bending, pulling, resulting in the musculoskeletal disorders like lower backache, shoulder pain, neck pain, causing poor physical fitness.

Table 1: Testing the equality of average PEFR L/min of Office section workers and other sections workers

Groups	**Calculated 't' value**	**Table 't'value**
Office v/s Doc	2.713	
Office v/s Processing	3.034	
Office v/s Milk pouching/packing	2.482	
Office v/s Product A	2.16	
Office v/s Product B	2.913	**$T_{(0.05,18)}$ = 1.734**
Office v/s Cold store	2.482	
Office v/s Mechanical	1.242	
Office v/s Boiler	3.487	
Office v/s Refrigeration	2.928	
Office v/s Godown	0.063	

Table 2 : Testing the equality of average Neutrophil % of Office section workers and other sections workers

Groups	**Calculated 't' value**	**Table 't' value**
Office v/s Doc	-2.80	
Office v/s Processing	-3.68	
Office v/s Milk pouching/packing	-1.67	
Office v/s Product A	-2.25	
Office v/s Product B	-2.18	**$t_{(0.05,18)}$ = -1.734**
Office v/s Cold store	-2.737	
Office v/s Mechanical	-1.418	
Office v/s Boiler	-3.48	
Office v/s Refrigeration	0.089	
Office v/s Godown	-0.768	

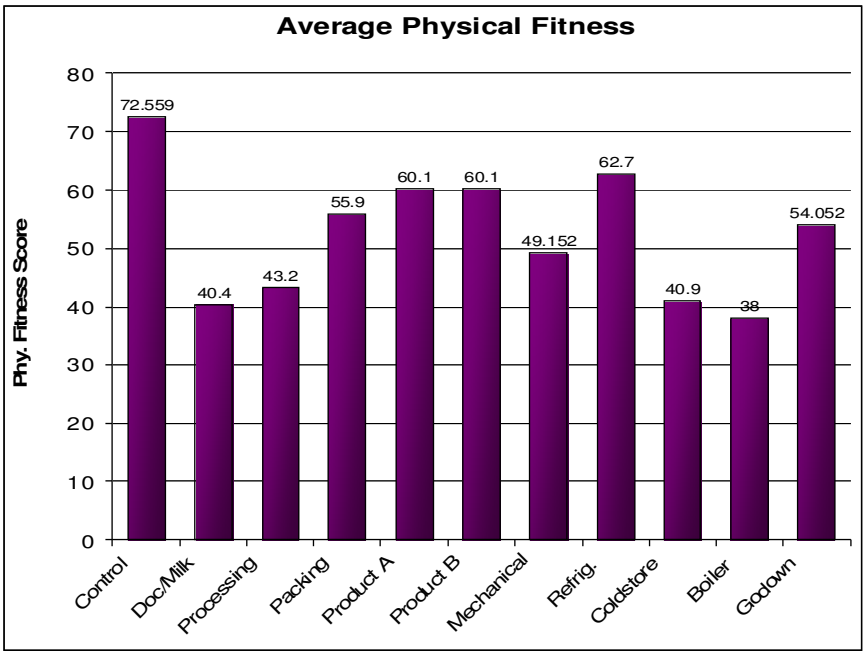

Figure 1. Average physical Fitness of Workers in Gokul Dairy

Conclusion:

Good house keeping, training, effective maintenance of the machinery and safety devices are the vital factors in improving the working environment in the dairy plant. It would have telling effect on the safety and productivity. Prevention and elimination of the hazards is of paramount importance. Awareness among the work force and the occupational health development should ensure the availability, accessibility and affordability of primary occupational health service will ensure the safety, welfare and well-being of the dairy worker. While working the worker interacts with colleagues, the work, work place, environment, which is physical, chemical and biological. Research is an important tool for the development of occupational health, providing scientific basis for policy making, priority setting, problem solving, professional training and evaluation. The study carried out and its finding would help the dairy management to become aware of the working condition and occupational hazards and stress faced by the dairy plant workers of Kolhapur Dudh Utpadak Sangh Ltd. and implement the programmes that would work for the hazard free work environment, safety and welfare of dairy workers.

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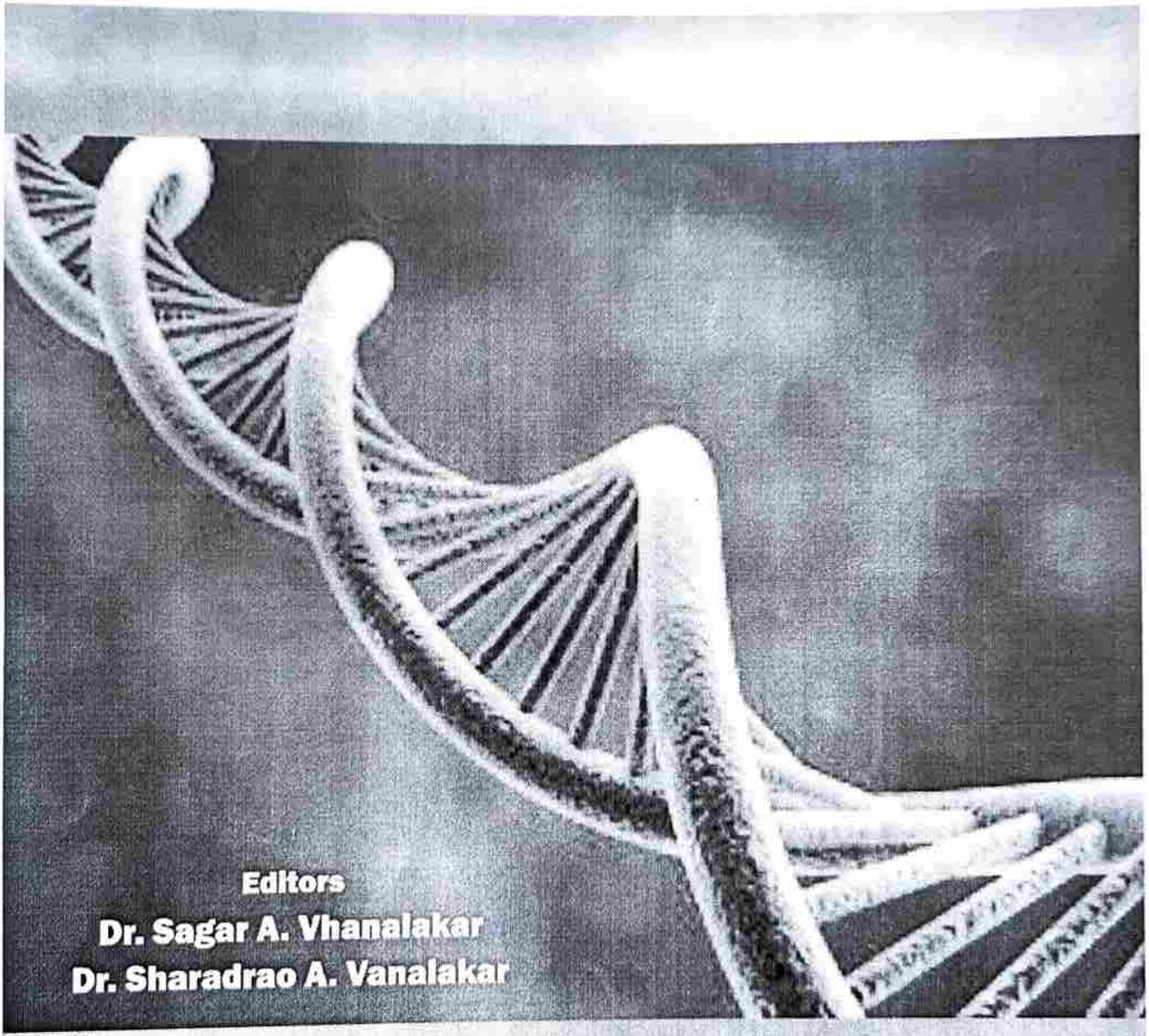

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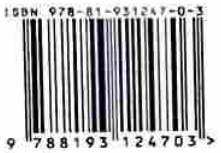

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CHAPTER 4

SOME STUDIES ON HAND GRIP STRENGTH (HGS) OF THE WORKERS IN DAIRY INDUSTRY

ISBN:
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ABSTRACT

The present study deals with the Hand Grip Strength of workers from different sections involved in Gokul Dairy. The working continuously in cold environment has directly reflected on the physical, mechanical, organizational environment and working conditions of the workers. The workers have been asked with left and right hand separately to squeeze the Dynamometer for maximum duration of 5 minutes. No any other part of the body was allowed to move while squeezing. For the each worker two trials for each hand have been recorded after 15 seconds recovery. The highest and lowest average left grip strengths 44.2 Kg and 34.6 have been observed for workers of Mechanical section and Cold Storage sections, respectively. Further these workers are found to be suffering from body ache, lack of grip strength, increased heart beats, palpitation, joint pains etc. Further for all workers the grip strength for non dominant hand is found 10% lower than the dominant one. Some preventive steps have been suggested for the well-being, health, competence of workers and the product, profit and the economic growth rate of the Dairy occupation is concerned.

KEYWORDS: Dynamometer, Grip Strength, Health, Competence

INTRODUCTION

The present industrial workers working in highly complicated environment is getting complicated with the environmental and health problems due to modern development. Even though the modern technical machineries have considerably decreased the physical burden of the work but there are still some unfavorable side effects of the modern development which have created problems like noise, vibration, excessive temperature etc.

The present study consists of the diary industry and different sections involved in processing milk and other dairy products. This is directly reflected on the physical, mechanical, organizational environment and working conditions. Working conditions includes cleanliness, light, heat, ventilation, physical energy, required length of the work day, irregularity of the work hours such as night shifts or the rotation of shifts, physical hazards exposure to possible industrial disease and similar conditions that

directly or indirectly influence the workers happiness, satisfaction or dissatisfaction while working. These conditions have a very wholesome influence on the efficiency and morale of the industrial workers. Concept of Industrial health implies the mere absence of an ascertainable disease or infirmity. Industrial health is the outcome of the interaction between the individual and the working environment. The workers are often exposed to the occupational hazards at their work place in addition to common community health hazards. Industrial health aims at protecting the workers against any health hazards, which includes the physical and mental attitude of workers suited for the jobs and skill. Industrial health comprises measures to establish and maintain the highest possible degree of physical and mental well being of the workers.

Erogonomics is the science of fitting work place conditions and job demands to the capabilities of the working population. It is an approach or solution to deal with a number of problems like work-related rnusculoskeletal disorder. Since last 25 years the Bureau of Labour Statistics (BLS) is conducting annual survey of occupational injuries and illness and as per the reports the Musculoskeletal disorders seems to be the most prevalent medical problems. It had been reported in 1995 that 308,000 or 62% of all illness cases were due to disorders associated with repeated trauma. There were 367,424 injuries due to over-exertion in lifting 65% affected the back 93,325 injuries due to overexertion in pushing and pulling objects.

Dairy industry plays a very important role in improving the economy of the Indian country since substantial contribution has been added to the national economic growth. It is more dependable and perennial source of income as compared to the agriculture sector. Kolhapur Zilla Sahakari Dudh Utpadak Sangh Ltd. a co-operative organization which is radically known for its most prominent brand name 'Gokul' has carved a special place in the growth of dairy industry in Maharashtra. The workers in the various sections of the Gokul Dairy plant have been exposed to various occupational hazards and stresses. The problems related to loading and unloading of cans, lifting of cans, and continuous bending in awkward position which directly or indirectly affect on the physical and mental health of the dairy workers seems to be of specific interests as far as happiness, health and humanity is concerned.

The present study has been carried out to evaluate the physiological responses of the workers engaged in dairy industry, in particular, the workers devoting their duties at Gokul Dudh Sangh, Gokul Shirgaon, located in the Kolhapur district of Maharashtra state.

MATERIALS AND METHODS

Dynamometer is required to measure the grip or forearm muscle strength. Hand Grip Strength (HGS) is important for catching, lifting and throwing. The Dynamometer was used to test the hand grip strength of the dairy workers. The workers were asked to hold and squeeze the Dynamometer (Danish electronics 0 to 100 Kg) with the maximum isometric effort for 5 seconds. The handle of the Dynamometer was adjusted according to the requirement. Jamar Dynamometer is referred to as the

best tool in the measurement of grip strength, but due to cost effectiveness we preferred the Danish one. Without hand movement no other part of body was allowed to move. The two trials for each hand of the workers under study were recorded after 15 seconds recovery between each effort.

Table 1: Values about expected scores of the workers

Sr. No.	Rating	Males (Kg)	Females (Kg)
	Excellent	>64	>28
02	Very Good	56-64	34 - 38
03	Above average	52-56	30 - 32
04	Average	48-52	26-30
05	Poor	40-44	20-22
06	Very poor	<40	<20

This is a simple and commonly used test of general strength level. It is also useful to record whether the worker is left or right handed. Non dominant hand normally scores 10% lower than the dominant one.

RESULTS

The multiple bar diagram given in Fig. 1 represents the left and right average horizontal and grip strengths in Kg for the workers from different dairy sections. Figures shown are the average Horizontal right and left grip strength in kg of the workers. The workers in product A section have the highest average right grip strength which is 49 kg and the workers in Doc, Processing, Cold store and Boiler sections have the lowest average right grip strength 38.4 kg. . The workers in Mechanical section have the highest average left grip strength which is 45 kg and the workers in processing section have the lowest average left grip strength 33.7 kg.

There are two product sections viz. A and B. The Product A section consists of the products like Butter, Ghee and Powder sections while in the Product B section different products like Shrikhand, Paneer, Lassi and Curd have been produced.

Fig. 2 represents the multiple bar diagram of average vertical right and left grip strength in Kg of the workers working in different sections of the dairy. The workers in product A section have the highest average right grip strength which is 46.6 kg and the workers in cold store section have the lowest average right grip strength 36.5 kg. The workers in Mechanical section have the highest average left grip strength which is 44.2 kg and the workers in cold store section have the lowest average left grip strength 34.6 kg.

Fig. 1: Average grip strength (horizontal) of dairy workers

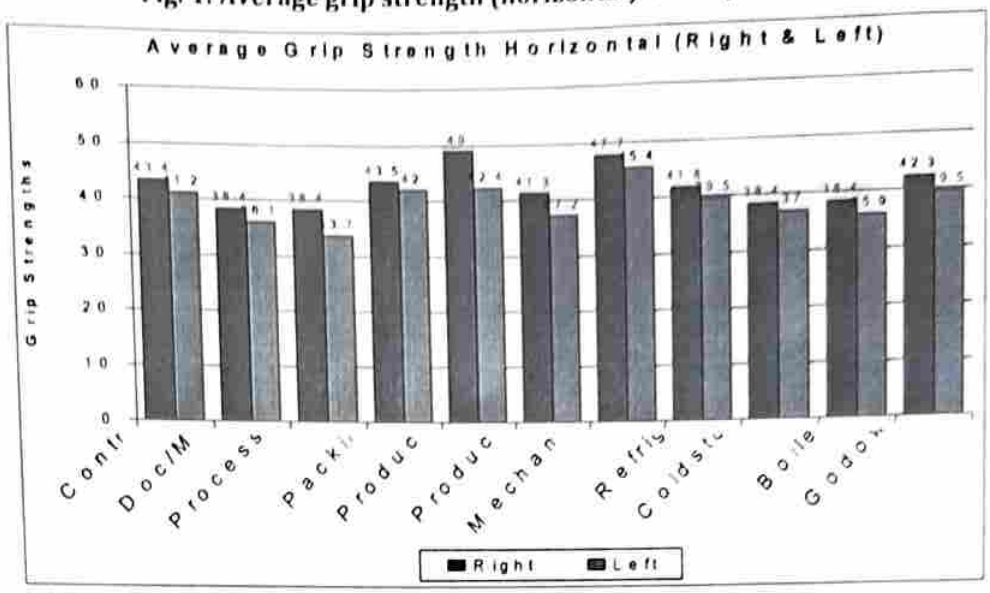
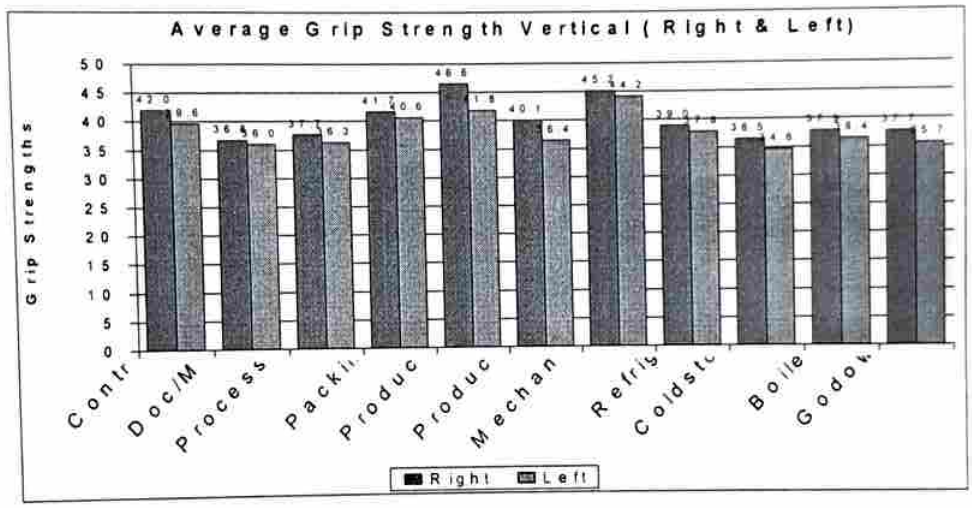


Fig. 2: Average grip strength (vertical) of dairy workers



DISCUSSION AND RECOMMENDATIONS

Dairy industry is one of the oldest occupations of the world. From the workers health matter, it is interesting to study the work place environment, work place hazards and stresses in dairy plant as they have to face the various occupational hazards, which diverges from section to section. The workers suffer from physiological stress factors like heat, cold, humidity, dust and chemical factors like gases particularly the effect of ammonia gas. The awkward position while carrying out the work has potential to cause musculoskeletal disorders.

Ergonomic survey of the various sections has revealed the physical, chemical, biological and musculoskeletal related problems owing to potential hazards and stress factors. When the worker comes in

contact with vibrating surface, machinery or equipment for prolonged periods occupational hazards of vibration stem out. Adverse health effects have been observed to take place from vibration at frequencies 2 to 1,000 Hz. Hand-arm vibration causes damage to blood vessels and nerves in the fingers, which is known as hand-arm vibration syndrome. This causes a loss of grip force and reduced touch. The use of smaller hand-held vibrating tools can cause carpal tunnel syndrome. The whole body vibration causes disorders of the bowel and the circulatory, musculoskeletal and neurological systems. The research study has shown that exposure to vibration can cause complaints about the joint pain, stiffness in the hand, arm, shoulder and particularly in the wrist.

In Gokul Dairy the workers working in Milk processing section and Refrigeration sections have to remain constantly in contact with the machines. The compressors in Refrigeration section causes noise level of 130 dB in addition to the vibrations. The workers in this section suffer from body ache, lack of grip strength, increased heart beats, palpitation, joint pains etc.

According to Tochihara (1997) there are two types of cold workplaces viz. outside work place in winter, an artificially cold environment. When the work in the artificial cold environment is done throughout the year, it is stressful to the workers. There are six cold storage rooms having the temperature varying from 0°C to –4°C and –18 °C to -20°C at Gokul Dairy. The workers in these sections have to work most of the time of their duties for unloading the trolleys of final Milk Products. The frequency of a worker depends upon the products to be stacked. Nearly half to 1 hour the worker remains inside the Cold storage room. These workers are found to be suffering from frostbite, shivering, numbness of extremities, poor coordination, fungal infection, cold and cough, less grip strength.

Handgrip strength indicates forearm muscle strength. It is important and most required for carrying out a number of tasks like lifting, catching, throwing the objects. The hand grip strength test carried out at various section of the dairy plant has revealed that dairy workers from Product A section have the highest average of grip strength 46.6 kg right and 41.8 kg for left. The workers of the cold store have the lowest average right grip strength 36.5 kg and lowest average of the left grip strength 34.6 kg. Hand grip strength between 40-44 kg is rated as poor and below 40 kg is rated as very poor. The workers working in Office, Packing, Product A and B, Mechanical sections have the right hand grip strength in between 40-46.6 and those working in Milk Reception, Doc, Milk Processing, Packing, Refrigeration, Cold store, Boiler and Godown sections have average range between 36.5 kg to 39.0 kg. As far as the left highest average of left hand grip strength the workers of the Mechanical have highest of 44.2 kg and the workers in Cold store section have the lowest average of 34.6 kg. It is found that that for all workers the non dominant hand normally scores 10% lower than the dominant one as far as both hands grip strength is concerned. The dairy workers working in the various sections of the dairy plant have shown the poor to very poor performance in the hand grip strength indicating poor physical fitness. The occupational hazard like cold, heat and personal health status are the reasons for this poor rating.

Kagan and Levi (1974) observed that to be able to identify the risk factors in the working environment and their negative health effects, a continuous monitoring is necessary including integrated occupational

environment and health statistics. Data gathering should be premised on a holistic view of the employee and their working life and include physical, chemical, environmental, psychological and socio-economic factors.

Protection of the workers is very important and necessary. Preventive measures are very important for workers well-being, health and competence. The following recommendation seems to be helpful to increase the productivity, efficiency and well-being of the dairy workers.

- Machines causing vibration must be identified.
- The type of vibration whether whole body vibration or part body vibration has to be recognized using expertise of specialists.
- Vibrating machines should be replaced with less vibrating machines.
- Vibrations absorbing material should be used at floor joints.
- Durations of the work should be minimized.
- Regular rest breaks should be given to the workers working on vibrating machines.
- Workers should be transferred after some period from one section to other sections, to minimize monotonous work.
- Anti-vibration gloves should be provided.
- The job should be redesigned to minimize the use of hand-held vibrating surface.
- To reduce the hazards of cold faced by the workers working in the cold storage and cold rooms, they should be trained to recognize the signs of frostbite.
- Workers should be trained to recognize the signs of hypothermia and the precautions taken while working in the cold with necessity of proper use of protective clothing and equipment.
- Rest allowance should be allowed to workers for purpose of recuperation from fatigue resulting from effects of manual task and adverse working conditions.

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