APPENDICES
Appendix 1:

Subject information sheet

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Project name: Pune Gestational diabetes (GDM) study: Elucidation of the role of maternal nutrient status during pregnancy, with emphasis on selected anti-oxidants, on maternal glucose tolerance and pregnancy outcome

A project focusing on “better health for mother and child”

You are being invited to take part in this research study as part of a PhD program, in diabetes unit KEM hospital, Pune. Your participation in this study is voluntary. Before you decide to participate it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Once all your questions have been adequately answered you will be asked to sign a consent form.

Diabetes has emerged as one of the most important health concerns of people today. Owing to highly pressurized lifestyles coupled with unhealthy eating habits, there has been an increase in the number of people that suffer from such life style diseases worldwide. Similarly the Burden of chronic disease like diabetes is growing in India as well. One of the many reasons being nutritional transition. In pregnancy, also, diabetes (gestational diabetes) has known to have adverse effects on mother and fetus during pregnancy and their later life. Therefore we are going to examine the relationship between life style factors like food habits physical activity, stress, and body composition and circulating levels of glucose and vitamin C. gestational diabetes and other effects like premature delivery.

The study has been approved by the Ethics committee of KEM hospital research center, Pune.

The invitation is open to women who:

- Are in 3rd trimester of a single-tone pregnancy who are healthy or with diagnosis of gestational diabetes
- Live in Pune city and attend antenatal clinic after 28 weeks of gestation

The objective of the project is:

- To make pregnancy care even better
- To assess life style pattern of pregnant mothers and help/teach them to choose healthy way.

**What are the possible benefits of taking part?** The said investigations and examinations will be offered free of cost to you. Results of these tests will be disclosed to you, your treating physician and research staff involved in the study. All the study participants will be offered with a report of blood investigations done in the study.

**What do I need to do if I decide to participate in the study?**

The following information will be acquired from your medical records: (weight, height, blood pressure, Ultra sonographies which are available.)

You will be interviewed by research assistant to get information related to the study, using a questionnaire. (Demography information, medical and obstetrical history, physical
activity, diet and general health of mother and her family). Information on your dietary habits will be obtained using 24 hour dietary recall and food frequency questionnaire.

An oral glucose tolerance test will be done to check your blood glucose levels. A total 20 ml venous blood will be drawn at 3 time points: (fasting, 1 hour and 2 hours after a glucose drink. your remaining blood will be stored for further analysis.(with just one time pricking).

If you agree to participate in the study, you have the right to see which information has been registered about you and your family. You also have the right to correct any mistakes in the registered information. If you choose to withdraw from the study, you can demand that the collected test results and information be deleted, unless the information has already been used in the analysis or used in scientific publications.

After completing the visit, you will continue to be treated /visited by your doctor as usual. All information will remain confidential.

Is there any risk in participating in this study?
There is no risk in participating in this study.

Can I withdraw from the study at any time?
You are free to withdraw from the study at any time point during the course of the study. If we decide to discontinue your participation in the study, we will discuss it with you. This will not affect the medical care being given to you otherwise.

Contact for further information:
For further information about this study, please contact: Dr. C. S. Yajnik /Ms. Hedyeh Masoodi, Diabetes Unit, KEM Hospital Pune (020-26111958, 020-66405731)

Thank you for taking time to read and consider the information in this leaflet.

Consent form:
I have carefully read the information about “Pune gestational diabetes study” project being conducted by PhD student in diabetes unit KEM hospital research center, Pune. I have discussed and understood the purpose and procedures of this study. This was discussed with me with the language I understood.

I am aware that I will have to undergo medical examination and blood tests.

I am fully aware that I can opt out of the study at any time. I understand that my tests performed in the study will be free.

My identity will be kept confidential and information will be used for research purpose only. Study information will be accessible to principle investigator, study coordinators, research staff, ethics committee members, regulatory authorities, and not to anyone else without my prior permission, even if I opt out of the study.

I am aware that if I have any queries or need more information regarding this study, I may contact any of the persons, on the numbers provided in the attached information sheet.

I agree to take part in this research study, and to cooperate for the various tests without any sort of pressure or monetary gain.

Subjects signature or left hand thumb impression:………………………………………………………………………..

Name of the signee (subject)……………………………………………………………………………………………..

In case of thumb impression impartial witness’s signature………………………………………………………………………..

Date:……………………………………………………………………………………………..

Name of the signee (witness)……………………………………………………………………………………………………

Study coordinator’s/ investigator’s signature………………………………………………………………………………………

Date:……………………………………………………………………………………………..

Name of the signee (investigator)……………………………………………………………………………………………………

Husband’s signature………………………………………………………………………………………………………………

Name/date:………………………………………………………………………………………………………………

Gestational diabetes study: (GDS)
Date:
ANC card no: diabetes unit file number:

In which hospital do you plan to deliver?

**A. DEMOGRAPHIC DATA OF PREGNANT MOTHER:**
Q1. Name: (first/middle/last)
Q2. Contacting address: (land mark if any)
Q3. Phone/mobile number:
Q4. Age of pregnant mother in completed year (date of birth):
Q6. Education of pregnant mother:
   1. Illiterate 2. primary 3. secondary 4. Graduation
Q7. Occupation: 1. Non-employed 2. Employed
   Please specify………..
Q8. Family type: 1. Nuclear 2. Extended
Q9. Number of family members: Adults: children (<12 yrs)
   Per capita unit…
Q10. Total income of family (Rs/month) : <10000 10000-20.000 >20.000 
   (………………..Rs)

**B. OBSTETRIC/MEDICAL HISTORY:**
   If yes please specify, by entering the code: (1. Father 2. Mother 3. siblings 4. Children 5. Other)
Q12. Current obstetric history: G……P……A……..D……
Q13. Length of last birth interval: ………
Q15. If yes treatment 1. Diet 2. OHA 3. Insulin
Q16 babies: single twins other (triplets…)
Q17. Events by date (if more than one please mention all by date):
   5. Other (EP…)
Q21. Status:
1. Alive □ 2. Early neonatal death (up to 7 days) □ 3. Late neonatal death (8-28 days) □

C. ANTENATAL INFORMATION/ANTHROPOMETRIC MEASUREMENTS:
Height (cm): ……….. Pre-pregnancy weight (kg): ……….
Weight gain (kg) at the time of interview: ……….. weight (kg) at the time of interview………….
Weeks of gestation at the time of interview: ……….
Total weight gain during pregnancy: ……….. pre-pregnancy BMI……
LMP………….. EDD…………….. BP at time of visit………….

D. INVESTIGATIONS:

<table>
<thead>
<tr>
<th>Trimester</th>
<th>Date</th>
<th>Wks of gestation</th>
<th>Hemoglobin (g/dl)</th>
<th>RBC count /m³</th>
<th>Fasting Blood Glucose (mg/dl)</th>
<th>Glucose 1hrs PG (OGTT) mg/dl</th>
<th>Glucose 2hrs PG (OGTT) mg/dl</th>
<th>Vitamin C (µmol/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second (24-28w)</td>
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<td></td>
</tr>
</tbody>
</table>

E. ANTENATAL ULTRA-SOUND REPORTS:

<table>
<thead>
<tr>
<th>date</th>
<th>Weeks of gestation</th>
<th>HC</th>
<th>FL</th>
<th>BPD</th>
<th>AC</th>
<th>placenta</th>
<th>Amniotic fluid</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

F. PRESENT OBSTETRIC INFORMATION/COMPLICATIONS:
Q22. Fetal macrosomia1.Yes □ 2. No □ (……..weeks)
Q23. Polyhydraminos Yes □ 2. No □ (……..weeks)
Q24. Pre-term labor Yes □ 2. No □ (……..weeks)
Q25. Maternal anemia (<10.5g/dl) Yes □ 2. No □ (……..weeks)
Q26. IUGR: Yes □ 2. No □ (……..weeks)
Q27. oligohydraminos Yes □ 2. No □ (……..weeks)

G. DELIVERY/POST-PARTUM INFORMATION:
Date of delivery……….weeks ……….days
If LSCS 1. Emergency □ 2. Elective □
IV Dextrose □ Insulin infusion □
If 2, 3 cause…………………….. □
Q31. Sex of baby: 1. Male 2. Female
Q32. Mother alive 1. Yes 2. No if 2 reason.............
Q33. PROM(premature rupture of membrane) 1. Yes 2.No

H. NEONATAL COMPLICATIONS:
Q34. Hypoglycemia 1. Yes 2. No
Q35. Respiratory problem? 1. Yes 2. No
Q36. Hyperbilirubinemia 1. Yes 2. No
Q37. Hypocalcaemia 1. Yes 2. No
Q38. Neonatal mortality 1. Yes 2. No
Q39. Admission to NICU 1. Yes 2. No

I. DIETARY HABITS:

Q41. Non-vegetarian:

<table>
<thead>
<tr>
<th>Food item</th>
<th>Y/N</th>
<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
<th>Rarely/occasionally</th>
<th>Amount</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egg</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Fish</td>
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<td></td>
<td></td>
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<tr>
<td>Mutton</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Chicken</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Prawn</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Beef</td>
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</tr>
</tbody>
</table>

Supplements taking:
Q42. Taking iron tablet in pregnancy? 1. Yes 2. No if yes since when------- Number of tablets/day............ Frequency daily (OD)/BD/other............

Q43. Taking calcium tablets during pregnancy? 1. Yes 2. No if yes since when-

Number of tablets/day............ Frequency daily (OD)/BD/other............

Q44. Are you taking any vitamin? 1. Yes 2. No If yes since when------- Number of Tablets/day............ Frequency daily (OD)/BD/other............

Q45. Are you taking nutritional supplements? 1. Yes 2. No name.......company....
If yes since when------- Number of tablets/day.............
Q46. **Types of oil used for cooking: (to find out EFA and vitamin E status)**
1. Ground nut oil
2. Sun flower oil
3. Safflower oil
4. Palm oil
5. Mustard oil
6. Soya bean oil
7. Coconut oil
8. Mixed
9. Other (butter, pure ghee, vanaspati (dalda), corn oil, rice bran oil, olive oil, cotton seed oil)

If using mixed oil, please specify which oils and in what proportion.

**Quantity required per month:**
- Oil -------kg
- ground nuts(shengdane) -------kg
- sesame -------kg
- dry coconut(suke khobare) -------kg
- Fresh coconut(ole khobare) ------- number/month
- Sugar -------kg
- jaggery(goola) -------kg

**Vitamin A:**
Q47. How many times per day do you take yellow fruits (like citrus fruit, mango)?
1. 1 time
2. 2-3 times
3. >3 times
4. Other

Q48. How many times per day do you take yellow /green leafy vegetables(bhaji)(like pumpkin(bhupale), carrot(gajar), spinach)?
1. 1 time
2. 2-3 times
3. >3 times
4. Other

Please specify the portion size.

**Dietary habits which may influence on formation of more free radical in the body:**

<table>
<thead>
<tr>
<th>item</th>
<th>Y/N</th>
<th>daily</th>
<th>weekly</th>
<th>monthly</th>
<th>Rarely</th>
<th>Amount/type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fast foods/ready to eat foods(pizza, magi, pasta, pavhbajji, sizzlers, Chinese foods, idli, vadapav)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2. Eating outside</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3. Sweet snacks (chocolate, ladoo, halwa, sweetened fruit juices, cola beverages, jam, jellies, other soft drinks)</td>
<td></td>
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<tr>
<td>4. Fried/salty snacks (farsan, roasted papad, bundhi, chivda wafers, samosa, cutlet, puries chips, burger)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>5. Bakery products (toast, biscuit cream roll, dough nuts, khari, butter cake)</td>
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<td></td>
</tr>
</tbody>
</table>
Q50. Do you have morning sickness now? Yes ☐ No ☐

J. SMOKING HABITS:
Q51. Do any of family members at home smoke in your presence (at least once per day)? Yes ☐ No ☐
Q52. Do you smoke? Yes ☐ No ☐
Q53. Do you chew any kind of tobacco? Yes ☐ No ☐

K. Q54. LIFE STRESS:
During the past one year have you had any of the following things happen to you? If so, simply circle only one number following those items which has occurred in your life recently (and only those items that apply to you).

<table>
<thead>
<tr>
<th>Numbers</th>
<th>Life event</th>
<th>Life change units:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Slight 1</td>
</tr>
<tr>
<td>1.</td>
<td>Change in social activities</td>
<td>10</td>
</tr>
<tr>
<td>2.</td>
<td>Change in sleeping habits</td>
<td>10</td>
</tr>
<tr>
<td>3.</td>
<td>Change in residence</td>
<td>10</td>
</tr>
<tr>
<td>4.</td>
<td>Change in work hours</td>
<td>15</td>
</tr>
<tr>
<td>5.</td>
<td>Tension at work</td>
<td>20</td>
</tr>
<tr>
<td>6.</td>
<td>Small children in the home</td>
<td>20</td>
</tr>
<tr>
<td>7.</td>
<td>Change in living conditions</td>
<td>20</td>
</tr>
<tr>
<td>8.</td>
<td>outstanding personal achievements</td>
<td>25</td>
</tr>
<tr>
<td>9.</td>
<td>problem teenagers in the home</td>
<td>25</td>
</tr>
<tr>
<td>10.</td>
<td>Trouble with in laws</td>
<td>25</td>
</tr>
<tr>
<td>11.</td>
<td>Change in responsibilities at work</td>
<td>25</td>
</tr>
<tr>
<td>12.</td>
<td>taking over a major financial responsibility</td>
<td>25</td>
</tr>
<tr>
<td>13.</td>
<td>Foreclosure of mortgage of loan</td>
<td>25</td>
</tr>
<tr>
<td>14.</td>
<td>Change in relationship with spouse</td>
<td>30</td>
</tr>
<tr>
<td>15.</td>
<td>loss of a close friend</td>
<td>30</td>
</tr>
<tr>
<td>16.</td>
<td>Gain of a new family member</td>
<td>35</td>
</tr>
<tr>
<td>17.</td>
<td>Sex difficulties</td>
<td>35</td>
</tr>
<tr>
<td>18.</td>
<td>Pregnancy</td>
<td>35</td>
</tr>
<tr>
<td>19.</td>
<td>Change in health of a family member</td>
<td>40</td>
</tr>
<tr>
<td>20.</td>
<td>Personal injury or illness</td>
<td>45</td>
</tr>
<tr>
<td>21.</td>
<td>loss of self-confident</td>
<td>45</td>
</tr>
<tr>
<td>22.</td>
<td>Death of a close family member</td>
<td>50</td>
</tr>
<tr>
<td>23.</td>
<td>marital separation</td>
<td>55</td>
</tr>
<tr>
<td>24.</td>
<td>Divorce</td>
<td>65</td>
</tr>
<tr>
<td>25.</td>
<td>Death of spouse</td>
<td>80</td>
</tr>
</tbody>
</table>

L. PHYSICAL ACTIVITY QUESTIONNAIRE (before pregnancy): (IPAQ)
Q55. Remember pre-pregnancy duration, or seven days before you come to know about your pregnancy,
1A. in a week, how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics or fast bicycling? Think about only those physical activities that you did for at least 10 minutes at a time. ..........days per week
1B. How much time in total did you usually spend on one of those days doing vigorous physical activity? ..........hours.........minutes
Or none □

2A. again think only about those physical activities that you did for at least 10 minutes at a time. In a week, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace? Do not include walking........days per week
2B. How much time in total did you usually spend on one of those days doing moderate physical activity? ..........hours.........minutes
Or none □

3A. during a week on how many days did you walk for at least 10 minutes at a time? This includes walking at work and at home, walking to travel place to place, and any other walking that you did solely for recreation, sport, exercise or leisure........days per week
3B. How much time in total did you usually spend walking on one of those days?
........hours.......minutes
Or none □

4. During a week, how much time did you usually spend sitting on a week day, while at work, at home, while doing course work and during leisure time. This includes time spent sitting at a desk, visiting friends, reading, travelling on a bus, or sitting or lying down to watch television.
........hours........minutes
**Vitamin C rich foods**

Date: - ___/_____/______  D: Daily W: Weekly, M: Monthly, Y: Yearly

How often do you yourself consume the following food items?

<table>
<thead>
<tr>
<th>No</th>
<th>Food Item</th>
<th>Daily6</th>
<th>Weekly5</th>
<th>Monthly3</th>
<th>Occasional Yearly2</th>
<th>Never1</th>
<th>Frequency amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>FRIUTS:</strong></td>
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<tr>
<td></td>
<td>goose bury/Amla/anvla</td>
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<tr>
<td></td>
<td>Guava/peru (white flesh)</td>
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<td>Orange</td>
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<td></td>
<td>Lime/musambe</td>
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<td></td>
<td>Papaya (ripe)</td>
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<td></td>
<td>Lemon/limbu</td>
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<tr>
<td></td>
<td>Pineapple/pineapple juice/ananas</td>
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<td>Custard apple/Seetaphal</td>
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<td></td>
<td>strawberry</td>
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<tr>
<td></td>
<td>Mango(ripe)/amba</td>
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<tr>
<td></td>
<td>pomegranate</td>
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<td></td>
<td><strong>VEGETABLES:</strong></td>
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<tr>
<td></td>
<td>Capsicum/dhobali mirchi</td>
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<tr>
<td></td>
<td>Coriander leaves/kothimber</td>
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<td>Cabbage/kobi</td>
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<td>Bitter guard/karela</td>
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<td></td>
<td>Cauliflower/phool gobeet</td>
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<tr>
<td></td>
<td>Fenugreek leaves/Methi</td>
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<tr>
<td></td>
<td>Tomato(ripe)</td>
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<tr>
<td></td>
<td>Spinach/palak</td>
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<td></td>
<td>Potato/batata</td>
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<tr>
<td></td>
<td>Green chilli</td>
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<tr>
<td></td>
<td>Tamarind pulp</td>
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<tr>
<td></td>
<td>Drum steak leaves</td>
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</tr>
<tr>
<td></td>
<td>Turnip</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Carrot/gajar</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Amaranth/Rajgira bunches</td>
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</tr>
<tr>
<td></td>
<td>Sprouted Bengal gram/matki</td>
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</table>

**SEMI-QUANTITATIVE FOOD FREQUENCY QUESTIONNAIRE**

**High ORAC foods**

Page 225 of 293
<table>
<thead>
<tr>
<th>No</th>
<th>Food Item</th>
<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
<th>Occasionally</th>
<th>Yearly</th>
<th>Never</th>
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<tr>
<td>1</td>
<td>Spices</td>
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<tr>
<td>2</td>
<td>Clove (lavang)</td>
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<tr>
<td>3</td>
<td>Cumin seeds/zeera</td>
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<tr>
<td>4</td>
<td>Curry powder/kadipatta</td>
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</tr>
<tr>
<td>5</td>
<td>Ginger/aalah</td>
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<tr>
<td>6</td>
<td>Nutmeg/jaiphal</td>
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<tr>
<td>7</td>
<td>Pepper black/kalimir, mirpud</td>
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</tr>
<tr>
<td>8</td>
<td>Turmeric/haldi</td>
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<tr>
<td>9</td>
<td>Cinnamon/dalchini</td>
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<tr>
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<td>Fruits</td>
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<td>10</td>
<td>Apple, raw</td>
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</tr>
<tr>
<td>11</td>
<td>Date/khajur</td>
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<td>12</td>
<td>Fig/anjir</td>
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<td>13</td>
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</tr>
<tr>
<td>14</td>
<td>Berries like strawberry/bore</td>
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<td>15</td>
<td>Pomegranate</td>
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<td>Vegetables</td>
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<tr>
<td>16</td>
<td>Coriander leaves/kothimber</td>
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<tr>
<td>17</td>
<td>Garlic raw/lason</td>
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<td>18</td>
<td>Onion (red.raw)</td>
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<tr>
<td>19</td>
<td>Spinach/palak</td>
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</tr>
<tr>
<td></td>
<td>Nuts</td>
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<td></td>
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</tr>
<tr>
<td>20</td>
<td>Almonds/badam</td>
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<tr>
<td>21</td>
<td>Cashew nuts/kaju</td>
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</tr>
<tr>
<td></td>
<td>Beans (pulses and legumes)</td>
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</tr>
<tr>
<td>22</td>
<td>Black beans/kala chana, kale vali</td>
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<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>23</td>
<td>Kidney beans/Rajma</td>
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<tr>
<td>24</td>
<td>Cow peas, black eyes/white vatana</td>
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<td></td>
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</tr>
<tr>
<td>25</td>
<td>Lentil/masoor</td>
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</tr>
<tr>
<td></td>
<td>Miscellaneous</td>
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<tr>
<td>26</td>
<td>Dark/milk chocolate</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>27</td>
<td>Pop corn air-poped</td>
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</tbody>
</table>

**24 Hour Recall (week day)**

**Date:** ____/____/_____

<table>
<thead>
<tr>
<th>Time:</th>
<th>Food Item:</th>
<th>Serving:</th>
<th>Serving Unit:</th>
</tr>
</thead>
</table>

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## 24 HOUR RECALL (weekend day)

DATE: _____/_____/_______

<table>
<thead>
<tr>
<th>Time:</th>
<th>Food Item:</th>
<th>Serving:</th>
<th>Serving Unit:</th>
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<tbody>
<tr>
<td>Early morning</td>
<td>Breakfast</td>
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<tr>
<td>Mid day</td>
<td>Lunch</td>
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</tr>
<tr>
<td>Afternoon snack</td>
<td>Dinner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bed time</td>
<td></td>
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</tr>
</tbody>
</table>
या अभ्यसारात पशुपति महिला सहभागी होऊं शक्ततात।
★ मुख्य गोरख आहेत हे लिंगीत हातांची आहेत, ज्या निरोगी आहेत व चर्चा
गोरेदर्शणातील महिलेच हिंसित पाहतात आहेत अशा महिला
★ ज्या पुष्पमाला रहावत व के. ई. एम. इष्टांत गेल्याचे २५ से २८ आहवकाळीवाचा
आधी भेट देऊ शक्ततात।

या अभ्यसाराचे उदेश्य:
★ प्रसिद्धपुरुष कालातील धोक्कापाक पेक्षा
(जास्त वचनमापणाचा
शेष, प्रसिद्ध कालातील वाटर इविस्त विविधता 'महेन्द्री') यांचा
अर्थातीत रंगांमयीत, गोरेदर्शणातील महिलेच, गोरोदर्शणाचा निरंतर खालेर
होणारे शेखर (अनुरूप विवरणाचे वाचताना) यांचा अभ्यस्त करणे.
★ गोरोदर्शणाची खराबते मेळणे (जास्त वजन वाढणे, जास्त मांजो
चुटुंबसाचे सेवन कमी इंद्री आक्षिप्तकंद सेवन, कमी शारीरिक हालात अनेक
गोरोदर्शण) यांचा अर्थातीत रंगांमयीत, गोरेदर्शणातील महिलेच, गोरोदर्शणाचा
निरंतर खालेर होणारे शेखर (अनुरूप विवरणाचे वाचताना)

या अभ्यस्त शाबासाची काय फायदे होतात?
या अभ्यस्ताऱ्यांना कर्मचारी धरणाऱ्याचा सत्ता ताकत गोरेदर्शण वैभवावाचा वेगळे निम्नलिखित चालू होता. या भांडणाऱ्यांनी
निश्चित करून तुम्ही ती तुमच्या उपयोगात करणावा. गोरोदर्शणासाठी. सर्व सहभागी निर्णयांना हे
भांडणाऱ्यांना निश्चित करून ती तुमच्या उपयोगात करणावा. (रत्न गृहाला, बाच्च्यांच्या साधारणतः चेक करणावा)

म्हणून या अभ्यस्ताऱ्यांचे सहभागी होण्याचे उद्देशी तर भाला काय करावे
लागेल?
हुनासा पुरीत भाषण करणारा लागतील,
कविता, गंधे, स्वस्ती, जाडी, हात, फाती, व करणारा वेळ वाले नोंदणामुळे वेळात वेळात तसेच
सादृश्य विविधता वेळात. सवीकारणी सादृश्य वेळात १५ मिनिट. सचत ( प्रति ३ गणाचे
प्रत्येक) गृहाला वेळात वेळात अलग अंबाई वाचावलीक युगाच्या कलाकृतीनंतर तुम्ही अनेक सोनेकी
करणारा वेळात.

या अभ्यस्ताऱ्यांसमजित माहितीसाठी काही म्हणून तुम्हांचा विवरणासाठी वेळात.
(या माहीती प्रादेशिक एवढणकक्षा व फार्मासायी माहिती, गुण्यांचा तंत्र्यास क्रायान्याची माहिती, अस्पताल, आरोग्याच्या व
धारणाच्या कार्याच्या आरोग्यावराती माहितीविवरणाच्या वेळात) तसेच दोन विवरणांमध्ये
केल्या आहाराची व विशेषतः आहे अंतरांत वेळात वेळात आहाराची माहिती विवरणासाठी
वेळात.
या अथायासारस्यान व अथायासारी संगमित सर्व चारण्या गोचर केल्या जातील. अथायासायवतिरिक अपवर्तन आपेक्षायी निर्गीत जर वाही चारण्या अपवर्तन धूर्धर्गाठी करणाराच वाचकत्वाच तर त्याचा खर्च तुवाहास करण्या लागेल. या अथायासात सहभागी होपण्यासाठी तुवाहास काही मोजाद्दला दिला जाणार नाही.

टुकडी जर या अथायासात सहभागी होण्यासे उपविके तर तुवाहास हे प्रकाशाचा अधिकार आहे की हुपवा तुक्क्या सुऱ्योगवाची वाचनासाठी वेळी आहे. जर त्याच्या काही चुका आढळल्यास त्या बोधाकर प्रकाशाचा अधिकार तुवाहास आहे, जर आपण या अथायासाला वाहेर पडताले तर तुकडी चर्चा चारणी अत्याचार कादुडू टाक्याच रांगू, शक्ता. जर ते या आत्में शोक निष्कर्षस्तित संरक्षणचे निष्कर्ष कादुडूसाठी वाहरे नस्तील तर आपण्या स्थानीय नवुहासपैकी वाही स्थान सावर वाहे. जर आपण या परवाहची कर्ता तर हे राय (साउदर) पुढील काही अथायासांती आपण्या शेंड वाहे. जक आपण हे राय परवाहची परत्याची नाकार्यस्मित तर ते राहिलेले रात नव कादुडू गेले. वाच तुक्क्या अथायासाच बाह्याच्या काहीही परिणाम होणार नाही. राहण्या नवुहास तुपणे नव धातुवाहास येणार नाही. त्याने एक ओळख क्रांतिकारांना ओळखले जाईल.

जर अपवर्तन आपेक्षिक काही बदल झाले आणि अपवर्तन धूर्धर्गाठी अथायासाला सहभागी कादुडू वाचासारी वाचीले तर अपवर्तन या अथायासाला वाहेर पाण्यासाठी संस्थी तेजस्वी गेले.

या अथायासात सहभागी आपेक्ष आपेक्ष इतर कुठलायी अथायासात सहभागी होऊ शकावाही नाही. शेषर्यांच्या वेळ आपणांनार तुवाहास तुम्मा नेहमीत वाक्यांतरे निष्कर्षाची तपासली करता गेले. सर्व नाहीतील गुण तेजस्वी गेले.
या अभ्यासात सहभागी होण्यास काहीं जोखीम आहे का?
या अभ्यासात सहभागी होण्यास काहीं होण्यास नाही. फक्त रत्न नमुना पेटाना आपल्याला पुढे टेस्टबॉक्ससाठी दुधें केले. रत्न नमुना पेटाना तो प्रशिक्षित च्याकिग्रंण, काँब्ज पुरवून मधुमेह विभाग के.इ. एम. हॉस्पिटल, पुणे येथे मेण्यात येईल.

मी या अभ्यासातून काहीसाठी बाहेर पडू शकते का?
या अभ्यासातील सहभाग पूर्णपणे एंडिजस्क आहे. तुम्हाला या अभ्यासातून बाहेर पडणाऱ्याचे पूर्ण स्वास्थ्य अध्ययन आहे. जर आहेही तुम्हाला या अभ्यासातून काळजी तर त्याविवेक आहेही अभ्यासातील काळजी कसून त्याविवेक काळजी भरणाई वागणार नाही.

अधिक माहितीसाठी संपर्क साधारण
डा. सी. प. यालिक / हेडहेड महुदा
मधुमेह विभाग, के.ई.एम. हॉस्पिटल, पुणे
फोन : 020-26111158, 020 - 66401237

आपण हे माहितीप्रद वाचण्या व समजूणाऱ्यासाठी केले दिस्यावधील आपले आपल्यांना आहेत.
संस्कृती पत्रक

मी मान्यतीतप्रकार दरिद्रती मान्यती पुण्यतील गर्भवस्तुश्री नगरमुळे अथायात : गर्भवस्तुश्रील उज गाथारुपमुळे आई व बालकंद्रा आलेयाच्या होणारा प्रियात्रांना अथायातयो या बिखापणीसव गाथतीती वाचतील आहे. हा अथायात ची. अथायात करणारी विदाहितीनी के. ई. व. होस्पिटल सिस्टम सेंटर वेळे करणार आहे. मला वा अथायास्वीरीसव मान्यतीती व पद्धत सफल्यता आहे. मला समजत वा आय भागेएवा मला ही मान्यती तेयात आली आहे.

मला हे मान्यता आहे की मला काही तत्त्वाच्या व रूप तपासणी करावी सावत.

मला हे मान्यता आहे की मी या अथायास्वूपी कर्मांही बाहेर पडू शकते. मला हे मान्यता आहे की मी या अथायास्वूपी किंवा जाणण्याच्या वाचत्या मोक्त आहे.

माजी एकूण गुरू उद्यमात देशीत व मान्यतीती रक्षा संशोधनसाधारणेंच्या प्रभारी जाईल, या अथायास्वूपी संकल्पित शास्त्री मान्यतीती, मी जरी मान्यता आलेल्या अथायास्वूपी मध्ये ती कर्माएँ संभव, या अथायास्वूपी अथायास्वूपी पर्यंत संशोधन वहीं तो तसदी मूल्यवान, नितिनिहारी सन्तती, निमायिक मंडू गोला वाचत्याची परत नाही.

मला हे मान्यता आहे की मला मी अथायास्वीरी संशोधन असल्याने आणि मान्यतीप्रकार दिलेल्या कोणाशी ही संपूर्ण साधन नाही शकले निरसन करणे मला पडते.

मी अथायास्वूपी संशोधनाच्या साधनामुळे मान्यता देत आहे. लते ही अथायास्वूपी किंवा जाणण्याच्या वाचत्याच्या मी साधनांच्या कर्मात, त्याच्या काळात कोणत्याही मोबदल्याची अपेष्का नाही.
To whomsoever it may concern

This is to certify that Ms. Hedyeh Masoodi, PhD student from Health Science department, working under the guidance of Dr. Yajnik, has performed plasma vitamin C analysis of her samples in Department of Zoology, under the supervision of Dr. Saroj Ghaskadbi.

Prof. B. B. Nath,
Head,
Department of Zoology
HEAD
Department of Zoology
University of Pune

Department of Zoology, University of Pune; Pune-411 007 (India)
Telephone: 020-25601435, 25601437; Telex: 25690917
Figure 8.1.1. The gestational age score: the weight, height and head circumference can be plotted on the infant's growth chart. This information is how the infant is diagnosed as SGA, LGA, or AGA.
8.1.2. Intra uterine weight for gestation chart
Figure 8.1.3. Neonatal Gestational Age, physical Maturity (Ballard chart)

Figure 8.1.4. Neonatal Gestational Age, neuromuscular Assessment (Ballard score)
University of Pune

Rules Governing the Presentation of Thesis for the Degree of
Doctor of Philosophy (Ph.D.)

1. Submission:
   A candidate shall submit to the Registrar four copies of his thesis. If the degree is awarded, the first copy of the thesis shall be kept in the University Library, the second in the appropriate Department or Institute, the third shall be returned by the University to the candidate’s supervisor.

2. Binding:
   The copies of the thesis shall be bound in cloth covered boards with leaves permanently secured.
   The front cover shall bear the title of the thesis, the name of the author, the name of the degree for which the thesis is submitted and the year of submission.
   The spine of the thesis shall bear the name of the author, the degree for which the thesis is submitted, the name of the supervising Department or Institute and the year of submission. Optionally it may also bear the title of the thesis. The information shall be printed along the spine in such a way that it is readable when the volume is lying flat with the front cover uppermost.
   If the thesis consists of more than one volume, the front cover of each spine shall also bear the number of each volume.

3. Paper and Type:
   All copies of the thesis shall be presented in a permanent and legible form in typescript or print. Copies produced by xerography or comparatively permanent processes will be acceptable. Drawings and diagrams should be in black ink.
   Paper of good quality and sufficient capacity for normal reading should be used.
   The size of the sheets used should normally be A4 (i.e. 21.0 cm. 29.7 cm. approx.)
   Margins at the binding edge shall be not less than 4 cm. and other margins not less than 2 cm.
   Double or one-and-a-half spacing may be used in typescript, except for industry quotations or footnotes where single spacing may be used.

4. The Title Page and The Text etc.:
   (a) The title page of the thesis shall give the following information in the order listed:
      (i) the full title of the thesis and the subtitle, if any;
      (ii) the total number of volumes if more than one and the number of the particular volume;
      (iii) the full name of the author;
      (iv) the degree for which the thesis is submitted;
      (v) the name of the University;
      (vi) the name of the department, institute or centre in which the research was conducted;
      (vii) the month and year of submission.
   (b) A table of contents shall immediately follow the title pages.
   (c) If a list of tables and illustrations is provided, it should follow the table of contents and should list all tables, photographs, diagrams, etc. in the order in which they occur in the text.
   (d) Any acknowledgements shall be on the page following the table of contents.
   (e) If the thesis contains any material which the author has used before, this fact shall be indicated in a declaration immediately following the acknowledgements.
(f) There shall be abstract of the thesis. The abstract shall follow the acknowledgements and declaration.

(g) For abbreviations not in common use a key shall be provided with the full term followed by the abbreviation in brackets.

(h) The thesis shall be divided approximately into chapters, sections, and subsections. The system of headings should be consistent and should provide a clear indication of changes in content, emphasis and other features which occur at each stage of the work.

References cited in the text may be identified by one of the two methods, either—

(i) by numbers typed as superscript, or if on the line, in round brackets, immediately following the relevant word or phrase in the text. or

(ii) by citing the author’s name, date of publication and the page number(s) in round brackets immediately following the relevant word or phrase in the text (e.g. Cgomsy, 1982 : 22-25).

(i) Appendices shall follow the main text. The style of the appendices shall be consistent with the style of the main text.

(j) The list of references should be arranged in accordance with the system of citation used. When using the method given in (h i) the references should be listed in the order in which they are identified in the thesis. When using the method given in (h ii) they should be listed alphabetically by the author’s surname.

In both cases the list should enable the reader to identify the work cited and to locate the specific pages referred to.

(k) If bibliography is supplied it should be arranged in a logical order, for example in broad subject classes and within each class, alphabetically by author.

5. Illustrative Material:

(a) Wherever practical, diagrams, maps, illustrations, computer printout published papers and tables shall have a binding margin of at least 4 cm. and should, if possible, be bound in the thesis nearer the appropriate text.

(b) Material which cannot be conveniently bound in text (such as large maps, slides, sound or videotapes, cine films) shall be packaged in such a way that it can be bound with the thesis. If the amount of such material is substantial, it should be gathered into a supplementary volume and packaged in a rigid container similar in format to the bound thesis. Unbound material and its packaging shall both be marked with the author’s name, initials and the degree for which the work is submitted in such a way that it can be readily linked with the thesis and it shall contain appropriate instructions for use.
8.2.1. **Antioxidant defense system:** (This and next page is all from srilaxmi, 2007)

“Major antioxidant mechanisms involved in fighting free radical damage are:

- Interaction of ascorbic acid and glutathione (GSH) with oxidants and oxidizing agents.
- Scavenging of free radicals and singlet oxygen by vitamin E, ascorbic acid, \( \beta \)-carotene and super oxide dismutase (SOD).
- Reduction of hydroperoxidase by glutathione peroxidase (GSHPx) and catalase enzymes
- Binding of transition metal by various chelators and repair of cellular damage by various metabolic activities.

**Combating free radicals and reactive oxygen species:** Potentially injurious effects of free radicals and reactive oxygen species are prevented by a well organized antioxidant defense system.

- The first line of defense is prevention. The multistep reduction of oxygen to water in the mitochondria is carried out by cytochromes and other metalloenzymes held together so that the intermediates like superoxide are not released into the cell. Similarly ions of the transition metals like iron and copper which can trigger reactive oxygen species formation are bound or sequestered by proteins like transferring and ceruloplasmin, to keep them out.

- The second line of defense is provided by the antioxidant enzymes present in all cells. They speedily attack the reactive oxygen species and inactivate them. Superoxide dismutase reacts with superoxide to give less toxic hydrogen peroxide.

\[
2O_2^- + 2H^+ \rightarrow H_2O_2
\]

Hydrogen peroxide is inactivated by two distinct enzymes. Catalase acts on the molecule and splits it to water and oxygen.

\[
2H_2O_2 \rightarrow H_2O + O_2
\]

A second enzyme glutathione peroxidase-GPx- detoxifies hydrogen peroxide, using a donor of antioxidants known as glutathione (GSH). GSH can exist in two interconvertible forms:

\[
2GSH \leftrightarrow \text{GSSG}
\]

It can give hydrogen to combat oxidant stress. It can also take up hydrogen and can be considered as a storage form of antioxidant. While combating free radicals and reactive oxygen species, glutathione gets inactivated to the oxidized form but can be regenerated by the cellular metabolism using another enzyme glutathione reductase.

\[
\text{GSSG} + \text{hydrogen donor} \rightarrow 2\text{GSH} \quad \text{(glutathione reductase)}
\]

The hydrogen donor is a nucleotide carrying the vitamin niacin. The enzyme GPx contains selenium. Dietary deficiencies of selenium and niacin also lead to antioxidant
deficiency. The enzyme superoxide dismutase contains copper, zinc, and manganese. Dietary deficiencies of these minerals also lead to antioxidant insufficiency. Riboflavin is needed for maintaining the niacin containing nucleotide participating step in GSH regeneration making riboflavin antioxidant vitamin.

The third line of defense is the damage control provided by the free radical scavengers. They react rapidly with the free radicals, inactivate them and arrest the chain propagation. In the process they are inactivated into less toxic radicals. The scavenger active on the cell membrane is vitamin E.

```
R
Free radical
R-H
```

```
NADP
e- Transport
NADPH
```

The inactive form of tocopherol on the cell membrane is regenerated on the cytoplasmic side with vitamin C as the hydrogen donor or free radical scavenger, rendering the vitamin oxidized and inactive. This in turn is reduced and regenerated by glutathione. The resultant oxidized glutathione is reduced to provide a continuous supply of GSH by a cellular enzyme glutathione reductase, which in turn needs the coenzymes of the vitamin niacin, NAD and NADP. These cofactors are provided by glucose metabolism with the help of coenzymes of riboflavin and these vitamins also share the work of free radical scavenging.

The final defense is by repair of the damage molecules and structures by accelerated removal of damaged molecules. For example, LPO products on the membrane are removed by specific phosphor-lipases which cleave the damaged fatty acyl chain which is followed by replacement with fresh fatty acid.

Damaged proteins are digested by proteases and damaged part of DNA are cleaved and repaired. The repaired mechanism is limited and is not exhaustive leading to diseases and disorders.”
8.2.2. TYPE 2 DIABETES MELLITUS ALGORITHM: (Mahan, KL, et.al, 2008) (Figure 8.2.1)

**CAUSES**

- Genetic factors

**PATHOPHYSIOLOGY**

- Type 2 Diabetes Mellitus (insulin resistance)
- Risk factors (physical inactivity, older age, obesity)
- Intake of excessive calories

**SYMPTOMS**

- (variable)
- Hyperglycemia
- Excessive thirst
- Frequent urination
- Polyphagia
- Weight Loss

**MEDICAL MANAGEMENT**

- 1. Abnormal pattern of insulin secretion and action
- 2. Decreased cellular uptake of glucose and increased postprandial glucose
- 3. Increased release of glucose by liver (gluconeogenesis) in early morning hours

**NUTRITIONAL MANAGEMENT**

- Lifestyle strategies (food/eating and physical activity) that improve glycemia, dyslipidemia, and blood pressure
- Nutrition education (carbohydrate counting and fat modification)
- Energy restriction to promote 5%-10% weight loss
- Blood glucose monitoring to determine adjustments in food or medications

**EXERCISE**

- Diagnosis: FBG > 126 mg/dl
- Nonfasting glucose > 200 mg/dl
- (with symptoms) Oral GTT > 200 mg/dl

**MONITORING**

- Blood glucose
- A1C testing

**MEDICATION**

- Sulfonylureas’ Non-sulfonylurea secretagogues
- Biguanides a-glucosidase inhibitors
- Thiazolidinediones
8.2.3. Impact of nutritional deficiency on pregnancy
(Principle of Nutrition, Srilaxmi, 2007): (Table 8.2.1)

<table>
<thead>
<tr>
<th>nutrient</th>
<th>Impact of deficiency on the mother</th>
<th>Impact of deficiency on the infant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy and protein</td>
<td>Abortion</td>
<td>Premature infant</td>
</tr>
<tr>
<td></td>
<td>Complications during delivery</td>
<td>Low birth weight infant</td>
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<td></td>
<td>Ketosis</td>
<td>Less brain cells</td>
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<td></td>
<td>May not gain enough weight to</td>
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<td></td>
<td>have normal lactation</td>
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<tr>
<td></td>
<td>PIH</td>
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<tr>
<td>Linoleic acid</td>
<td>-</td>
<td>Retarded fetal growth</td>
</tr>
<tr>
<td>Calcium</td>
<td>Muscular cramps</td>
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<td></td>
<td>Repeated pregnancy with poor</td>
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<td></td>
<td>diet can result in osteomalacia</td>
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<tr>
<td></td>
<td>During lactation breast milk may</td>
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<tr>
<td></td>
<td>be deficient in calcium</td>
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<tr>
<td>Iron</td>
<td>Hypochromic microcytic anemia,</td>
<td>Bone with less stores of iron</td>
</tr>
<tr>
<td></td>
<td>complications during delivery</td>
<td>and susceptible for anemia</td>
</tr>
<tr>
<td>Iodine</td>
<td>Goiter</td>
<td>Chance of getting goiter</td>
</tr>
<tr>
<td></td>
<td>Increased risk of miscarriage and</td>
<td>cretinism</td>
</tr>
<tr>
<td></td>
<td>still birth</td>
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<tr>
<td>Zinc</td>
<td>fetal mortality</td>
<td>reduced intra-uterine growth rate</td>
</tr>
<tr>
<td></td>
<td>fetal malformations including</td>
<td>low birth weight</td>
</tr>
<tr>
<td></td>
<td>CNS and teratogenicity</td>
<td>preterm baby</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>mortality</td>
<td>increased levels in fetus</td>
</tr>
<tr>
<td></td>
<td>PIH</td>
<td>more susceptible for vitamin A</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>Decreased calcium absorption</td>
<td>Calcium metabolism of fetus</td>
</tr>
<tr>
<td></td>
<td></td>
<td>is affected</td>
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<tr>
<td>Vitamin K</td>
<td>Decreased prothrombin synthesis</td>
<td>Increased risk of prenatal</td>
</tr>
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<td></td>
<td>Increased loss of blood during</td>
<td>hemorrhage</td>
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<tr>
<td></td>
<td>delivery</td>
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<tr>
<td>Thiamine, riboflavin, and</td>
<td>Deficiency symptoms</td>
<td>-</td>
</tr>
<tr>
<td>niacin</td>
<td></td>
<td></td>
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<tr>
<td>Folic acid</td>
<td>Megaloblastic anemia</td>
<td>Fetal malformation</td>
</tr>
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<td></td>
<td>Abruptation placenta</td>
<td>Neonatal tube defects, spina</td>
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<tr>
<td></td>
<td>PIH</td>
<td>bifida, congenital abnormalities</td>
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<td></td>
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<td>like hare lip, cleft palate,</td>
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<td></td>
<td></td>
<td>hydrocephalus</td>
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<td></td>
<td></td>
<td>Low birth weight</td>
</tr>
<tr>
<td>Vitamin B 12</td>
<td>Pernicious anemia</td>
<td>Premature baby</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>Premature rapture of fetal</td>
<td>Increased neonatal death rates</td>
</tr>
<tr>
<td></td>
<td>membranes</td>
<td></td>
</tr>
</tbody>
</table>

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8.2.4. Relationship between maternal and fetal nutrition: (Dietetics, shrilaxmi, 2007) (Figure 8.2.2.)

- Inadequate food intake and poor nutrient utilization
  - Reduced blood volume expansion
  - Inadequate increase in cardiac output
  - Decreased blood and nutrient supply to the fetus
    - Reduced placental size
    - Reduced nutrient transfer
    - Fetal growth retardation

**Share of nutrients:**
- Nutrients given to the fetus at the expense of mother: folacin, iron, vitamin C and B12
- Nutrients for which mother and fetus compete: B1, B2, B6, and D
- Nutrients for which mother has priority over fetus: I and vitamin A
- Nutrients not stored in the fetus: vitamin C, D and calcium
### 8.2.5. Congenital malformations in infants of diabetic mothers

(Hod M, et al, 2008, pg 175)  (Table 8.2.2.)

<table>
<thead>
<tr>
<th>Malformations:</th>
<th>Common</th>
<th>Rare, Occasional</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cardiac</strong></td>
<td>Corrected transposition</td>
<td>Tetralogy of fallot</td>
</tr>
<tr>
<td></td>
<td>Ventricular septal defect</td>
<td>Hypoplastic left heart</td>
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<td></td>
<td>Coarctation</td>
<td>Single ventricle</td>
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<td></td>
<td>Atrial septal defect</td>
<td>Double-outlet right ventricle</td>
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<tr>
<td></td>
<td>Cardiomyopathy</td>
<td>Pulmonic stenosis</td>
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<td></td>
<td></td>
<td>Anomalous venous return</td>
</tr>
<tr>
<td><strong>Skeletal</strong></td>
<td>Sacral agenesis</td>
<td>Polydactyly</td>
</tr>
<tr>
<td></td>
<td>Vertebral and rib anomalies</td>
<td>Syndactyly</td>
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<td></td>
<td>Limb reduction defects</td>
<td>Clinodactyly</td>
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<td></td>
<td></td>
<td>Clubfoot</td>
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<tr>
<td><strong>CNS</strong></td>
<td>Anencephaly</td>
<td>Occipital encephalocele</td>
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<td></td>
<td>Neural tube defects</td>
<td>Holoprocencephaly</td>
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<td></td>
<td>Microcephaly</td>
<td>septo-optic dysplasia</td>
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<td></td>
<td>Hydrocephalus</td>
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<td><strong>Uro-genital</strong></td>
<td>Hydronephrosis</td>
<td>Hypoplastic genitalia</td>
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<td>Renal agenesis</td>
<td>Micropenis</td>
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<td></td>
<td>Ureteral duplication</td>
<td>Ambiguous genitalia</td>
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<td></td>
<td>Multicystic dysplasia</td>
<td>Megalo-urethera</td>
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<td></td>
<td>Hypospadias</td>
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<tr>
<td><strong>Gastro-intestinal</strong></td>
<td>Duodenal atresia</td>
<td>Malrotation</td>
</tr>
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<td></td>
<td>Ano-rectal atresia</td>
<td>volvulus</td>
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<td>Esophageal atresia</td>
<td>Omphalocele</td>
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<td>Gastrochisis</td>
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<td>Diaphragmatic hernia</td>
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<tr>
<td><strong>Facial</strong></td>
<td>Cleft lip</td>
<td>Choanal atresia</td>
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<td></td>
<td>Cleft palate</td>
<td>Absent depressor anguli oris</td>
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<td></td>
<td>Ears</td>
<td>muscle</td>
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<td></td>
<td>microcia</td>
<td>fused orbits</td>
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<td></td>
<td>anotia</td>
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<td>atresia of canal ear</td>
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<td>hairy ears</td>
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<td>hearing loss</td>
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<td>Eyes</td>
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<td></td>
<td>cataract</td>
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<td>coloboma</td>
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<td>optic nerve hypoplasia</td>
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<tr>
<td><strong>Others</strong></td>
<td>Single umbilical artery</td>
<td>Laterality defects</td>
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<td></td>
<td></td>
<td>Tracheal stenosis</td>
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<td></td>
<td></td>
<td>Branchial arch anomalies</td>
</tr>
</tbody>
</table>
Figure 8.2.3: Pre-pregnancy weight gain graph. Reprinted with permission of Judith E. Brown, 1997 (Doberson DT, 1999)

Figure 8.2.4: Schematic illustration of vitamin C uptake and recycling in the cell. Vitamin C in its oxidized form, DHA, is transported into mitochondria via facilitative glucose transporter 1 and reduced to mitochondrial AA (ascorbic acid). Mitochondrial AA quenches ROS, protects the mitochondrial genome and inhibits mitochondrial membrane depolarization. The mechanisms involved in the uptake, trapping, and recycling of vitamin C in mitochondria appear to recapitulate the metabolism of AA in the cytosolic compartment (Sagun KC et al 2005).
Figure 8.2.5. A cartoon of tug of war illustrating hormonal action on blood glucose regulation (Satyanarayana U, et.al 2006)

Figure 8.2.6. Stages of the nutrition transition (Seymour L and Halpern MD, 2005)
8.2.7. Transcending reductionism in nutrition research: This represents the whole and the parts of diet and health. Starting from the top as whole, both diet and health may be reduced to parts (symbolized by the single rectangles and examples). The solid arrows indicate the usually studied relationships, and the dotted arrow indicates the relationship that should also be studied (Hoffman I, 2003)
Appendix 3:
by UNICEF, ICCIDD and WHO. Iodine in water will be analyzed using trimetric procedures.

Conclusion: This study will add recent scientific information on iodine status of pregnant women; therefore it may help health professionals when conceptualising iodine for pregnant women.

Presenting Author: Mandiwana, TC
Co-author: Mabasa, E

THE PREVALENCE OF OBESITY AMONGST TEENAGERS AT KGOLUTHWANA SECONDARY SCHOOL, CAPROCK, DISTRICT SOUTH AFRICA.

Introduction: During the past 15 years, obesity has emerged as a significant public health problem because of its increasing prevalence, as well as the morbidity and mortality attributed to it.

Objective: To determine prevalence of obesity amongst teenagers using anthropometric measurements and dietary intake

Methods: Descriptive study design was used to determine obesity and dietary intake amongst male teenagers (n=102) and female teenagers (n=116). The study was conducted at Kgoluthwana secondary school. Stratified random sampling was used to select participants. The research was conducted in a separate place and asked them questions while completing the questionnaires (Interviewer administered questionnaires) and anthropometric measurements were used to determine BMI. Statistical package for social science was used to analyze data. Food Composition Table was used to analyze dietary intake and descriptive statistics were used to interpret data.

Results: About 60% of male participants were overweight and 41% of female were overweight. Obesity was more prevalent in females at about 53.3% and 26.3% in males. The mean value for carbohydrates is 140.01 for female participants and 134.01 for males. The mean value for vitamin A for females was 244.81 and 397.01 for males.

Conclusion: The prevalence of obesity and overweight at Kgoluthwana secondary school is high. Most of the participants were found to be consuming fast foods more frequently. The diets that they consume on daily basis are rich in micronutrients. Level of physical activity was very low, the majority of the participants were exercising occasionally.

Key words: Obesity, overweight, prevalence, dietary intake

Presenting Author: Masoodi, H
Co-author: Kamat, TV

TRACE ELEMENT DEFICIENCY: RISKS IN PREGNANCY.
REVIEW OF ARTICLES PUBLISHED FROM 1997 TO 2015.

Introduction: Urbanization in developing countries comes along with changes in food habits and living conditions resulting in increased risk of non-communicable chronic diseases like diabetes. A woman, who has been well nourished before conception, begins her pregnancy with reserves of several nutrients so that the needs of growing fetus can be met without affecting her health. Until recently there have been few published studies which are focused on nutrients rather than glucose during pregnancy and their deficiency outcome like gestational diabetes. A systematic review of the literature was conducted as part of a comprehensive evidence report for this problem.

Materials and Method: Using PubMed bibliographic search engine, peer-reviewed studies was identified on micronutrient deficiency and its clinical outcomes during pregnancy. The following terms were searched: pregnancy complications, trace elements, zinc, chromium, selenium, iodine, magnesium, copper, epigenetic and early programming, gestational diabetes.

Result: Identified English articles that were published during the 23 years period were studied. During the past decades, most of articles which have documented in the field of nutrition and pregnancy, especially gestational diabetes have focused on macronutrient intake (Energy and carbohydrate) and on clinical outcomes such as Weight changes, need for insulin, anemia as well as maternal and infant outcome.

Conclusion: While the importance of pregnancy of a few micronutrient deficiencies, such as iodine and iron, has been long recognized, the role of many others being studied only recently. New approaches are needed to encourage and support more researches in the area of trace elements deficiency and risk of complications during pregnancy like gestational diabetes, pregnancy induced hypertension, pregnancy weight, low birth weight, infertility, etc.

Key words: pregnancy, zinc, chromium, magnesium, iodine, trace elements, micro-nutrient deficiency
University of Pune
INTERDISCIPLINARY SCHOOL OF HEALTH SCIENCES
Pune Public Health Conference 2013
Symposium on reproductive and child health

Pregnancy loss, birth defects and genetic disorders in India:
Epidemiology, social costs, health systems needs
11th - 13th February, 2013

There is sufficient evidence that preconception care reduces the complications of pregnancy including pregnancy loss, birth defects and genetic disorders. The Reproductive and Child Health (RCH) programme offers a spectrum of services ranging from the Adolescent Reproductive and Sexual Health (ARS) programme, antenatal care (ANC) services and several interventions targeted towards perinatal and early neonatal morbidity and mortality reduction. There is however a “crack in the continuum” as there are few pre-pregnancy interventions. Every year, women enter pregnancy with teratogenic risk exposures such as micronutrient deficiencies, pesticide exposure or tobacco habit. What is the prevalence of these risk factors amongst adolescent girls and women of reproductive age? Are 800 000 pregnancies actually affected each year in India? If the pregnancy outcome is a stillbirth, or results in early neonatal mortality, how do birth defects impact public health indicators? There are no government services for affected children and no education or support services for their parents. What is the quality of life of these children and their families? Can a low cost, population wide programme for prevention be suggested within the Reproductive and Child Health programme in India?

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Epidemiology, social costs, health systems needs
11th - 12th February, 2013

Birth defects - Act today!
Hedyeh Masoodi* and C. S. Yajnik**

*PhD scholar, Health Science Department, University of Pune under guidance of Dr. C. S. Yajnik, and corresponding author: Hed.mas@gmail.com **Director Diabetes research center, KEM hospital

**Background:** Obesity among women of reproductive age is increasingly prevalent in urban Indians and is associated with increased risk of adverse outcomes for mother and infant, such as diabetes. Obesity in young women is contributing to Norbert Freinkel’s 'fuel-mediated teratogenesis' in India and will contribute to intergenerational propagation of diabetes in young Indians.

**Aims and Objective:** The study investigated pre-gravid body mass index (BMI) as a risk factor for gestational diabetes mellitus (GDM).

**Research design and methods:** This is a preliminary report in a prospective cohort, using a nested matched case-control design, in two hospital settings in Pune city. The study is in progress. We determined pre-pregnancy weight by history and obtained height and weight gain during pregnancy. Glycemic status evaluated by random glucose and GDM was confirmed by a 75 g oral glucose tolerance test (OGTT) using IADPSG (International association of diabetes and pregnancy study group) criteria, using a threshold of fasting plasma glucose (FPG) 92mg%, 1 hour 180mg%, 2 hour 153mg%.

**Results:** We analyzed results in 195 women, of which 158 had normal glucose tolerance and 37 were GDM. Gestational diabetes cases had higher pre-pregnancy BMI (26.71±4.35 vs. 22.27±4.21kg/m²), higher age (30±4.8 vs. 27.02±3.84years) and a higher prevalence of family history of diabetes (53% vs. 39%). GDM women also had higher weight gain at the time of interview (8.82±1.47 vs. 6.87±1.53 kg) compared to non-diabetic control women.

**Conclusion:** The data suggest that GDM women have higher pre-gravid BMI and higher gestational weight gain compared to non-GDM women. Targeting women in reproductive age, for pre-conception life-style adjustments to normalize body weight might reduce the incidence of gestational diabetes and contribute favourably to reduction of diabetes epidemic in the country.
Pre-pregnancy over weight, modifiable determinant of gestational diabetes

Hodyeh Nasoofi, PhD scholar, Health Science Department, Pune University,
Dr. C. S. Yajnik, Director of Diabetes Unit KEM Hospital
Research Guide: Dr. C. S. Yajnik Co-Guides: Dr. K. J. Coyaj, Dr. T. V. Kamat
February 2013

Back ground

Effect of obesity

Variables of study and distracting factors

![Image of obesity and diabetes factors]

Parameters

<table>
<thead>
<tr>
<th>Parameters</th>
<th>GDM N=17 cases/SD</th>
<th>Nondiabetic N=150 control/SD</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>63.3±4.79</td>
<td>64.7±9.36</td>
<td>.008</td>
</tr>
<tr>
<td>Education in years</td>
<td>15.5±3.43</td>
<td>14.8±3.48</td>
<td>.006</td>
</tr>
<tr>
<td>Parity</td>
<td>0.88±0.78</td>
<td>0.46±0.50</td>
<td>.006</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>156.8±16.0</td>
<td>136.3±14.8</td>
<td>.006</td>
</tr>
<tr>
<td>Pre-pregnancy weight (kg)</td>
<td>84.7±7.1</td>
<td>55.0±13.6</td>
<td>.006</td>
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<tr>
<td>Pre-pregnancy BMI (kg/m²)</td>
<td>29.3±6.5</td>
<td>21.7±4.5</td>
<td>.006</td>
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<tr>
<td>Height gain at delivery</td>
<td>7.5±6.6</td>
<td>4.5±2.9</td>
<td>.006</td>
</tr>
<tr>
<td>Random glucose (mg/dl)</td>
<td>160.4±20.3</td>
<td>120.7±19.4</td>
<td>.006</td>
</tr>
<tr>
<td>2 hour post glucose level</td>
<td>175.0±26.9</td>
<td>135.5±15.0</td>
<td>.006</td>
</tr>
</tbody>
</table>

Conclusion

Our data suggest that GDM women have:

- Higher pre-pregnancy BMI (26.9±4.0 vs. 20.1±7.4 kg/m²).
- Higher gestational weight gain (15.5±3.43 vs. 14.8±3.48 kg).
- Higher parity (0.88±0.78 vs. 0.46±0.50).
- More educated (15.5±3.43 vs. 14.8±3.48 yrs).
- Higher fasting blood glucose (129.7±21 vs. 99.7±17 mg/dl).
- Postprandial glucose more in control BG category, which shows limitation of other modifiable factors rather than diet.

Methodology

In this study, we aim to examine role of one of pre-pregnancy risk factors (higher BMI) on risk of GDM in India. The study has been approved by the study.

Study Setting:
- Pune university hospital, women's ward.

Study population:
- 200 women, 150 controls.

Study Design:
- Cohort, matched, case-controlled, parallel, randomized controlled trial.

Study Duration:
- Ongoing

Exclusion:
- 24-28 weeks of gestation, singleton normal or GDM without any indication or serious problem, who are willing to participate.
- We determined pre-pregnancy weight by history and observed weight and weight gain during pregnancy. Gestational weight was calculated by subtracting pre-pregnancy weight from the nearest time postpartum (n=30). We compared pre-pregnancy weight gain with body weight gain during pregnancy: age and body weight and age-by body weight and age-by body weight gain during pregnancy. Statistical analysis was performed using Dunnett’s, Student’s t test, ANOVA, Pearson’s correlation, and logistic regression models.

Acknowledgement

Health science department, Pune University:
- Dr. Aruna Prat, Dr. T. V. Kamat

KEM Hospital:
- Dr. Sanjay Desai, Lab staff, Dr. Shaila Thakur, reception staff.

And respondents of this study

Page 255 of 293
Dear Hedyeh,

Thank you very much for your response to our Call for Papers and for submitting such an interesting proposal.

On behalf of the Steering Group I am delighted to say that you and your colleagues' paper has been ACCEPTED for presentation at the 2nd Global Conference "MAKING SENSE OF: FOOD", to be held in Athens, Greece, from Monday 4th NOVEMBER to Wednesday 6th NOVEMBER 2013. I look forward with great interest to meeting you and to hearing your paper.

If there is anything further we can do, please do not hesitate to contact us.

Don Sanderson
Rob Fisher

Joint Organizing Chairs

Making Sense of Food 2 - Athens

All communications for IDNet to:

Priory House
149B Wroslyn Road,
Freeland,
Oxfordshire, OX29 8HR
Tel: +44(0)1993 882087
Fax: +44(0)8074 601132

Company Information,
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From: jessica.pledge@idf.org
To: mahed.mahed@yahoo.com, jessica.pledge@idf.org

10/07/13

Abstract number: ME-0913
Abstract title: Intake of high oxygen absorbance capacity (horac) foods in second trimester and risk of development of gestational diabetes

Dear Ms Masoodi,

On behalf of the Programme Committee of the World Diabetes Congress 2013 Melbourne organised by the International Diabetes Federation, it is my pleasure to inform you that your abstract has been accepted by title.

Your abstract will be published on the abstract CD-ROM and the title will be published in the congress programme book.

Should the registration process be incomplete by this date, the abstract will not be published and will be removed from the programme.

All correspondence should be sent to my attention through Jessica Pledge, the Congress Programme Administrator.

With best wishes,

Professor Paul Zimmet AO
Chair, Programme Committee
Dear Ms Hedyeh MASOODI,

Thank you for submitting an abstract for the 8th World Congress on Developmental Origins of Health and Disease to be held in Singapore on the 17 – 20 November 2013.

On behalf of the Abstract Review Committee, we are pleased to inform you that the following abstract has been accepted for POSTER presentation:

Submission Number: DOHaD13-1644  
Abstract Topic Name: Gestational diabetes  
Title: VITAMIN C DEFICIENCY IN SECOND TRIMESTER AND RISK OF DEVELOPMENT OF GESTATIONAL DIABETES

All information regarding your abstract, authors and their affiliations will be considered as final as of the 12 August and will be submitted for the abstract book.

Please do not hesitate to contact us if you need further assistance. Kindly email us at dohad2013.hotreg@mci-group.com (registration) or dohad2013.abs@mci-group.com (abstract presentation).

Kind Regards  
Karen Ukil  
DOHaD 2013 Abstract Management Team  
C/O MCI Group Asia Pacific Pte Ltd  
Singapore
هواللهم
مام خمینی (ره) تعلیم و علم عیادت است

مروغ ۱۳۹۰/۱۱/۱۲

برابر خواهر کرامت مهرداد دانشجوی محرز دوره ز

بدینویسه از تلاش های شما فرهیخته عزیز عصره علم و فرهنگ در
راستای اهداف سند چشم انداز ملی و نفسه جامع علمی کشور تقدیر
می نماید. امیدوارم سرمایه شما تجلی همت و تلاش یت وقفه ای است که
در قاب ارزشمند علم و دانش می تشیند و امید است همواره از طلاه
داران نهضت تولید علم ایران اسلامی باشید. انشاء ا...

سید مهدی میر زاده
سرکار جهانی اسلامی ایران

محمدرضا کرمی
رئیس انستیتو تولید اسناد ملی
تکریم مهم‌های برجسته موجود حرکت کشور به سمت قنه‌های علمی می‌شود.

(مقام معظم رهبری حضرت آیت‌الله خامنه‌ای مهد الله العالی)

دانشجوی عزیز سردار خالیم هدی مصعودی

حضور فعال جامعه‌ای را در جشنواره انتخاب دانشجویان برتر علمی شهاب حسن به عنوان یک دانشجوی مستعد و موفق، از می‌نهم و آز یکانگی با تکل بر خدا و پشتیبانی و اعتماد به نفس توانسته‌اید در سنجش‌های علم و دانش بدرخیص صمیمانه به شما تبریک می‌گویم. این لوح تقدیر به‌پاس شایستگی‌های علمی به جامعه‌ای تقدیم می‌گردد.

نشان‌الله دی آینده ی تزیین دانشجویان ایرانی در سطح جهان

پدرخشنده.

-{متن فارسی در تصویر-}
Certificate of Completion
The National Institutes of Health (NIH) Office of Extramural Research certifies that Hedyeh Masoodi successfully completed the NIH Web-based training course “Protecting Human Research Participants”.
Date of completion: 08/16/2011
Certification Number: 727527
SOCIETY FOR INITIATIVES IN NUTRITION AND DEVELOPMENT
101, Vullari Apartment, Aundh ITI Road, Pune - 411007

CERTIFICATE OF PARTICIPATION

This certificate is awarded to
Ms. Kaidyeh

for participating in the workshop on ‘Orientation to Statistical Methods in Research’ on 15\textsuperscript{th} June, 2013 at Pune.

Date: June 15\textsuperscript{th}, 2013
Dr. (Mrs.) Shobha Rao,
In charge, Research & Training

SOCIETY FOR INITIATIVES IN NUTRITION AND DEVELOPMENT
101, Vullari Apartment, Aundh ITI Road, Pune - 411007

CERTIFICATE OF PARTICIPATION

This certificate is awarded to Hedyeh Masoodi

for participating in the workshop on ‘Scientific Writing’ on 27\textsuperscript{th} July, 2013 at Pune.

Date: July 27\textsuperscript{th}, 2013
Dr. (Mrs.) Shobha Rao,
Director, Research & Training
CERTIFICATE OF PARTICIPATION

This is to certify that Dr. [Name], has attended the "Pune Public Health Conference 2014 - IPHA-IAPSM Joint State Conference" organized by the Interdisciplinary School of Health Sciences, University of Pune on the 25th & 26th February 2014.

(Signature)
President
IPHA

(Signature)
Convenor
IAPSM
From adeindiajoournal@gmail.com
To Me
29 April 2014, at 3:20 PM

Dear Ms. Hedyeh Masoodi
We have received your article titled 'A comparative study on characteristics of gestational diabetes versus normal glucose tolerant Indian pregnant mothers' for Journal of Diabetes Education, ISSN: 2320-9968.
Your article has been published in Issue 4, October-December, 2013.

Thanks and Warm Regards,
Prof (Dr).H. B. Chandalia
Editor-in-Chief
A comparative study on characteristics of gestational diabetes versus normal glucose tolerant Indian pregnant mothers:

Authors: H. Massodi\textsuperscript{1}, S. Rao\textsuperscript{2}, T.V. Kamat\textsuperscript{3}

\textsuperscript{1}. Corresponding Author, School of Health Sciences, University of Pune, mahed.mahed@yahoo.com
\textsuperscript{2}. Director Research and Training, Society for Initiatives in Nutrition and Development
\textsuperscript{3}. Visiting Faculty, School of Health Sciences, University of Pune

Abstract:

Aims and objectives: To compare clinical features of gestational diabetes (GDM) and normal glucose tolerant group of Indian mothers.

Method: Forty two pregnant women with GDM and 158 gestational age-matched healthy pregnant women participated in this study at an average of 26 weeks of gestation. Antenatal information was obtained from hospital records. Height and weight were measured at the time of interview. BMI was elected as the only measure of obesity. Holmes and Rahe stress questionnaire was used to assess total life stress unit during pregnancy. Pre-pregnancy physical activity level was calculated using international physical activity questionnaire. GDM was diagnosed by 75 gm oral glucose tolerance test using International Association for Diabetes in Pregnancy Study Group criteria.

Results: GDM mothers had higher pre-pregnancy body mass index i.e. BMI (26.5±4.3 vs. 22.2±3.9kg/m\textsuperscript{2}), higher age (29.2±4.6 vs. 26.9±3.8 years), higher prevalence of family history of diabetes (61.9% vs. 39.3%) higher parity (59.6 vs. 38.6%) and higher rate of large for gestation (LGA) babies (38.1 vs. 8.2 %). GDM subjects also had higher weight gain at the time of interview (8.88±2.1 vs. 6.85±1.6 kg), higher total life change unit of stress [median (IQR), 60(50-80) vs. 35 (35-45)], and lower pre-pregnancy physical activity score [median (IQR), 300(250-360) vs. 1329(1121-1585)].

Conclusion: The present study confirmed conventional risk factors for GDM and additionally highlights the role of physical activity and stress. Targeting women in reproductive age, for pre-conception life-style adjustments to normalize body weight might reduce the incidence of gestational diabetes and contribute favorably to reduction of diabetes epidemic in the country.

Keywords: GDM, BMI, OGTT, stress, physical activity
Introduction:

Gestational diabetes mellitus (GDM) is carbohydrate intolerance of variable severity with onset or first recognition during pregnancy [1]. Gestational diabetes is a complication in about 5% of all pregnancies, also is increasing in prevalence, and is associated with complications of pregnancy and a long term risk of diabetes in both mother and off spring [2-6]. Prevalence of gestational diabetes in India is high but variable in different states, e.g. 16-17% in Tamil Nadu and 10% in Punjab [7].

It is already well known that higher body mass index (BMI) and sedentary life style are relative risk factors for GDM. Although GDM can be influenced by both genetic and environmental factors, the rapid increase in prevalence might be attributable to environmental causes. Among all risk factors for GDM, maternal overweight, and type of life style (as modifiable risk factors), seem to be crucially important. A number of studies have demonstrated a significant association between pre-pregnancy BMI and GDM [8-10].

Traditional risk factors for GDM with recent attention have been reported to be body fat percentage [8, 9, 11]. Similarly, family history of diabetes also has been shown to be a risk factor for GDM in case of Indian [10], Chinese [11] and other populations [15]. Additionally, diet especially calories and physical activity have also been shown to be associated with risk of GDM in different populations [9, 12, 13, 14]. In addition advanced maternal age and history of spontaneous abortion were also novel risk factors in Chinese population [11]. Grand-multi-parity was predictive too of future risk of diabetes in Caucasian and African-American population [16], and multiparous women were more likely to have GDM than nulliparous women [17].

Modest changes in pre-pregnancy BMI may decrease the risk of GDM substantially [8]. But, it is recognized that pre-pregnancy BMI and gestational weight gain depend on different metabolic pathways. Pre-pregnancy BMI represents maternal nutritional conditions before conception, while gestational weight gain is the expression of fetal-maternal physiological changes combined with genetic and nutritional factors [18], and especially in early pregnancy is associated with higher rate of GDM. Weight gain especially in early pregnancy is associated with higher rates of GDM [19]. The women suffering from GDM during previous pregnancy have higher risk for type two diabetes recurrences [20]. However, there is hardly study showing that previous history of polyhydraminos increases the risk of GDM.

Although, stressful events during pregnancy have been reported as an independent risk factor for GDM [21] only by few researchers, it needs attention as it is a potentially modifiable risk factor. All above could indicate that not all factors are modifiable for reducing risk of GDM. Nevertheless, physical activity level, dietary habits and management of stress certainly offer the opportunity for modifying and consequently reducing the risk for GDM as very few studies have examined their role especially in Indian women.
Material and methods:

Pregnant women of 24-28 weeks of gestation attending antenatal clinic from two hospital setting were studied. Women with singleton pregnancy, without any serious health problem or co-morbidities and willingness to participate were included. Present study was approved by Ethics Committee of King Edward Memorial Hospital Research Center. GDM was diagnosed by OGTT using International association of diabetes in pregnancy study group (IADPSG) criteria [22] (fasting >=92mg%, 1hour post glucose >= 180mg%, 2 hour post glucose >=153mg %).

Measurements:

Maternal information was obtained from outpatient records as well as face to face interview. The questionnaire contained six segments including maternal demographic information, obstetric and medical history, antenatal information and anthropometric measurements, life stress during pregnancy and pre-pregnancy physical activity history.

Maternal height and weight were measured in duplicate to assure accuracy. Tanita body analyzer (model BC, 601) was used to measure the weight of pregnant mothers and a plastic stadiometer was used to measure height. Mean of two measurements was used in analysis. Pre-pregnancy BMI was estimated by weight in kilogram divided by square of height in meter. Indian women classified as obese according to World Health Organization (WHO)’s recommended cut off for BMI for Asians. According to WHO BMI criteria, the range for normal BMI was 18.5-23 kg/m whereas BMI≥27.5 kg/m was considered obese [23].

Information regarding usual physical activity of mother prior to present study was obtained by using interview technique. The mother was asked the type of activity and duration of each activity during at least seven days prior to confirmation of present pregnancy.

Pre-pregnancy physical activity was measured using short form of International questionnaire for physical activity [24].

Data from the short International physical activity questionnaire (IPAQ) were summarized according to the physical activities recorded (walking, moderate, and vigorous activities) and estimated time spent sitting per week. Note that the sitting questions were developed as separate indicators and not as part of the summed physical activity score.

The weighted MET [(metabolic estimation rate)-minutes per week (METmin·wk⁻¹)] were calculated as (duration × frequency per week × MET intensity), which were summed across activity domains to produce a weighted estimate of total physical activity from all reported activities per week (MET·min·wk⁻¹). For brevity and clarity of presentation, only the total physical activity MET-minutes per week are reported [25]. The formulas were as follows:

Vigorous (minute/week) = 8 × vigorous activity (minute) × vigorous activity days
Moderate (minute/week) = 4 × moderate intensity activity (minute) × moderate intensity activity days
Walking (minutes/week) = \(3.3 \times \text{walking (minute)} \times \text{walking days}\)

Total physical activity MET (minute/week) = vigorous + moderate + walking

Sitting calculated as minutes of sitting on a week day, including any type of sitting like, reading, travelling by bus, visiting friends, doing course works, etc, and presented as sedentary score.

As there are no established threshold for presenting MET-minute the IPAQ committee decided that data should be reported as comparisons of median values and inter-quartiles ranges for different population.

Only values of 10 or more minute activities were included in the calculation. Scientific evidence indicates that episodes of at least 10 minutes are required to achieve health benefits. Responses less than 10 minutes were considered as zero [26].

In this study, stress was considered as confounder variable. To evaluate stress level, an international standardized questionnaire of social readjustment rating scale (SRRS) was used [27]. This scale was retested by Rahe et.al in 1970 and also in the year 2000 as a predictor of illness. In addition this scale was assessed cross-culturally, in Japanese and Americans [28], and Malaysians Americans [29]. Consequently, considering the diverse samples in these studies, Rahe and Holmes life stress questionnaire has reasonable measurement properties for monitoring population levels of stress among 18- to 65-yr-old adults in diverse settings.

However questionnaire was modified to suit the present study population. Both negative and positive events were included in the questionnaire. The extent of required adjustment was indicated in terms of stress score.

To measure stress according to Holmes and Rahe stress scale, the number of total life change units (TLCU) that applied to events in the past year of an individual’s life were added and the final score was given a rough estimate of how stress affect health. Recently this questionnaire was used to assess stress in Iranian population to estimate maternal stress in pregnancy [30].

The subjects were asked that “during the last twelve months has she had any of the following things happen to her, If so, simply circle the number following those items which has occurred in her life recently (and only those items that apply to her)”. Stress category was determined using following categories: scores greater than 300, major life stress, scores between 200-299 and 150-201 moderate life stress and mild life stress respectively and scores less than 150 indicates low life stress. Since this part comprised of some delicate questions, coded questionnaire was provided separately to the subjects, to keep confidentiality. As there are no established thresholds for presenting stress score data was reported as comparisons of median values for this population.

**Statistical methods:**

The relationship between maternal clinical history and risk of GDM was explored. Estimates are expressed as mean ± SD or proportions. To compare means of continuous variables, independent t-test, and
$\chi^2$ test were used to test differences in proportions. For skewed data log transformation was undertaken for conversion to normality. Z-Score were calculated to find out whether study variables were associated with onset of GDM. Analysis was carried out using SPSS Microsoft IBM version21.

**Results**

Our results of conventional risk factors for GDM (Higher age, BMI, parity, neonatal complications) as depicted in table one, are consistent with previous observations [10]. Mean values for various maternal characters studied are given for GDM and NGT mothers in table 1. It can be seen that GDM mothers were older by three years and had significantly higher pre-pregnancy BMI (26.5±4.3 Vs 22.2±39.9; p<0.001) compared to NGT mothers. Further, they also had significantly higher weight gain during pregnancy (13.8 ± 5.3 kg Vs 11.5 ± 2.9 kg; p<0.001). Proportion of women with history of diabetes, or abortion, or polyhydraminous or even that of GDM did not differ significantly among GDM and NGT group. Maternal parity was not associated with risk of GDM. It was however interesting to note that the median scores for activity were low while that for stress were higher among GDM mothers compared to NGT mothers.

**Discussion**

Our results of conventional risk factors for GDM were consistent with previous observations; extracting from t-test, chi-square and z score; including higher age and BMI [10], parity [17], family history of diabetes [10, 11, 16], advanced age [11], higher gestational weight gain [18], and pre-pregnancy BMI [18]. However, maternal history of abortion was not associated with GDM in contrast with findings of Yang H et.al, 2009 [11]. There was no relation between polyhydraminous and GDM, and borderline association between previous GDM and risk of GDM in next pregnancies.

Strengthening current research findings, Liu J, et.al, 2008 [14] have shown that higher level of physical activity during pregnancy leads to lower risk of GDM among previously inactive women. Also Dye TD et.al in 1997[31] reported lower percentage of physical inactivity in GDM subjects.

Torloni M.R et.al [32], meta-analysis based on 70 studies reported in last 30 years, strengthen that the risk of GDM is positively associated with pre-pregnancy BMI which was in line with our results. In another study, Kongubol A et.al [33], found that compared to normal weight women, obese Thai women (without metabolic problems) were not at increased risk for gestational diabetes mellitus (RR = 0.9 [95% CI 0.6–1.4]). Also Radesky JS et.al [34] in their study concluded that nutritional status on entering pregnancy as reflected by pre-pregnancy BMI is a stronger predictor of abnormal glucose tolerance than any dietary influences during early pregnancy. This prediction is in case of specific type of carbohydrate (whole grain) and fat (polyunsaturated fatty acids) and not whole carbohydrate and fat intake. Diet quality may influence DM and GDM incidence over the long term. And the relatively short duration of a single pregnancy may not allow time for diet to affect the risk of GDM. Hence they suggest that efforts to reduce rates of GDM should focus on reducing obesity prevalence among women of child-bearing age.
Hanley AJG et.al [35], has suggested the presence of a diabetes-prone phenotype within the nulliparous sub-cohort of their study population, which might contribute to infertility, seems to be contrary findings from present study. The subjects with history of higher parity were more prone to get GDM. In Another study by Nicholson WK, et.al [16], it is reported that multi-parity is predictive of future risk of diabetes after adjustment for confounders; however they did not assess the predictive effect of parity on GDM.

The rapid global rise in prevalence of type 2 diabetes constitutes a health threat to the individual and is a major burden for health economy. Therefore not only it is crucial to identify specific risk groups, targeting preventive strategies [36], but also an urgent need for safe low cost strategies to halt the diabetes epidemic is necessary.

Yet in commonly identified risk factors for GDM including maternal age, high parity, family history of diabetes, over weight status and obesity extent to which these factors contribute to the etiology of the disease is largely unknown.

Considering two facts that “India is passing through nutritional and life style transition” and “GDM is long term risk for both mother and fetus to develop diabetes in later life”; this study revealed that conventional risk factors for GDM persevere. Hence our observations on the modifiable risk factors assume importance.

Ascertainment of causality was not possible due to observational nature of study. Targeting women in reproductive age, for pre-conception life-style adjustments, comprise of normalizing body weight, increasing physical activity and management of stress might reduce the incidence of gestational diabetes and contribute favorably to reduction of diabetes epidemic in the country.

Table 1. Maternal nutritional status and physical activity
<table>
<thead>
<tr>
<th>Maternal parameters</th>
<th>GDM (n=42)</th>
<th>NGT (n=158)</th>
<th>Z-Score</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-pregnancy BMI (Kg/m²) (mean ± SD)</td>
<td>26.5±4.3</td>
<td>22.2±39.9*</td>
<td>-</td>
<td>0.00</td>
</tr>
<tr>
<td>Weight gain during pregnancy (Kg) (mean ± SD)</td>
<td>13.8±5.3</td>
<td>11.5±2.9*</td>
<td>2.85</td>
<td>0.00</td>
</tr>
<tr>
<td>Pre-pregnancy physical activity score median (IQR)</td>
<td>300 (250,360)</td>
<td>1329* (1121,1585)</td>
<td>0.98</td>
<td>0.32</td>
</tr>
</tbody>
</table>

*p=0.00 using independent t-test

Table2. Maternal clinical characteristics:

<table>
<thead>
<tr>
<th>Maternal parameters</th>
<th>GDM (n=42)</th>
<th>NGT (n=158)</th>
<th>Z-Score</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr) (mean ± SD)</td>
<td>29.2±4.6</td>
<td>26.9±3.8*</td>
<td>-</td>
<td>0.00</td>
</tr>
<tr>
<td>Family history of diabetes (%) §</td>
<td>19</td>
<td>5.7</td>
<td>2.85</td>
<td>0.00</td>
</tr>
<tr>
<td>History of abortion (%) §</td>
<td>26.2</td>
<td>20.3</td>
<td>0.98</td>
<td>0.32</td>
</tr>
<tr>
<td>History of polyhydraminous (%) §</td>
<td>2.4</td>
<td>0</td>
<td>1.55</td>
<td>0.11</td>
</tr>
<tr>
<td>History of GDM (%) §</td>
<td>4.8</td>
<td>0.6</td>
<td>1.83</td>
<td>0.06</td>
</tr>
<tr>
<td>Multi-para (%) §</td>
<td>59.6</td>
<td>38.6</td>
<td>2.97</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Using independent t-test|| and § Chi square

Table3. Maternal total life change unit (TLCU), stress score

<table>
<thead>
<tr>
<th>Maternal parameters</th>
<th>GDM (n=42)</th>
<th>NGT (n=158)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total life change unit (TLCU),stress score median (IQR)</td>
<td>60 (50,80)</td>
<td>54* (35,50)</td>
</tr>
</tbody>
</table>

*P=0.00 using independent t-test

Duality of interest:
The authors declare that there is no duality of interest associated with this manuscript.

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Literature cited:


TO WHOMSOEVER IT MAY CONCERN

This is to certify that Ms. Hedyeh Masoodi is PhD student at School of Health Sciences, University of Pune. Her area of research project is in clinical nutrition.

Her research topic is as following: “Elucidation of the role of maternal nutrient status during pregnancy with emphasis on selected antioxidants, on glycemic status and pregnancy outcome”.

Professor Bhushan Patwardhan
Director, School of Health Sciences