

# *Research Reach*

*Journal of Home Science*

Vol.6, No.2

July, 2007



Research Centre,  
College of Home Science,  
Nirmala Niketan  
49, New Marine lines,  
Mumbai - 400 020.

# RESEARCH REACH

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**RESEARCH REACH  
JOURNAL OF HOME SCIENCE**

Volume 6

Number 2

July 2007

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## EMOTIONAL INTELLIGENCE

Dr. Subhadra Prabhu

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Growing interest and proactive conscious awareness on 'Positive well-being' appeared to surface during the early 1980's. This issue slowly gained impetus and popularity over the years and held people's attention for almost a decade. Currently, the focus has shifted to a more concerted and specific component of positive well-being namely 'Emotional well-being'. Though this shift in focus has enthused researchers to expand the already existing knowledge on emotions in a wider perspective, the term 'Emotional Intelligence' remains a relatively new concept - a concept to be explored. Certainly, in the contemporary society, despite the abbreviation EI being commonly used, many are still unaware of the meaning, significance and implications of EI (Emotional Intelligence). Against this backdrop, the review paper airs questions, surfaces hidden assumptions, raises issues and highlights controversies and debates about the indispensable topic - EMOTIONAL INTELLIGENCE.

**KEY WORDS:** emotional intelligence

Emotional Intelligence (EI) is a fairly new concept because these words 'Emotional Intelligence' were initially coined and used by Salovey and Mayer only in the year 1990 (Salovey and Mayer, 1990). However, people were interested to know about it because when the Harvard Business Review published an article on Emotional intelligence in 1993, it attracted a higher percentage of readers than any other article published in that periodical in the last 40 years. ([http://en.wikipedia.org/wiki/Emotional\\_intelligence#Origins\\_of\\_the\\_Term](http://en.wikipedia.org/wiki/Emotional_intelligence#Origins_of_the_Term)). Also, ever since the publication of Daniel Goleman's book named 'Emotional Intelligence: Why it can matter more than IQ', Emotional Intelligence has become one of the hottest buzzwords. Given that Emotional Intelligence is so popular, it is important to understand what it really means and to be aware of the research and scientific facts on which it is based (Cherniss, 2000).

### What is the definition of 'Emotional Intelligence'?

Since EI is a new concept, the definition of EI is still in a state of flux. However, according to Rusiel (1992) 'Emotional Intelligence is an intelligence that involves the ability to monitor one's own and other's emotions, to discriminate among them and use the information to guide one's actions and thoughts'.

In the words of Mayer and Salovey (1993) 'Emotional Intelligence also called EI, describes an ability, skill or capacity to perceive, assess and manage the emotions of one's self, of others and of groups'.

Emotional Intelligence is defined by Bar-On (1997) as 'an array of cognitive capabilities, competencies and skills that influence one's ability to succeed in coping with environmental demands and pressures'.

Sundardas (2000) opined that Emotional Intelligence is an individual's capacity to acknowledge and use his emotions meaningfully. Kumar et al. (2005) defined 'Emotional Intelligence' as 'the ability to monitor one's own and other people's emotions and label them appropriately and to use emotional information to guide thinking and behaviour'.

Recently, Mayer et al., (2004) in their definition of EI, described it as the ability to perceive and express emotion accurately and adaptively (such as taking perspective of others), to understand emotions and emotional knowledge (such as understanding the roles that emotions play in friendship and marriage), to use feelings to facilitate thought (such as being in a positive mood, which is linked to creative thinking), and to manage emotions in oneself and others (such as being able to control one's anger).

Although conceptualizations of the definition of EI vary, comprehensively, EI includes a set of competencies falling into four major domains addressing:-

1. Self-awareness - including emotional self-awareness, accurate self-awareness, self-confidence
2. Self-management - including achievement orientation, adaptability, initiative, trustworthiness, conscientiousness and self-control.
3. Social awareness - including empathy, service presentation and organizational awareness and
4. Social Skills - including leadership influence, communication, developing others, change catalyst, conflict management, building blocks, teamwork and collaboration (Boyatzis et al., 2000)

While there is progress in the efforts to comprehend the term 'Emotional Intelligence', the swiftness with which the concept of Emotional Intelligence has caught on perhaps had inevitably created a gap between what we know and what we need to know. Understandably, this has stimulated and necessitated research initiatives and has also led to a great deal of controversy and debate among researchers and practitioners on this topic.

#### **Are Emotional Intelligence competencies innate / or can they be learnt?**

There has been an immense degree of skepticism whether emotional intelligence competencies are inherent or whether they can be learnt or developed. Some researches (Bradberry and Greaves, 2005) are of the view that EI is dynamic and that it can be learnt or increased whereas few others (Mayers et al., 2000) say that EI is genetically determined and hence is stable and cannot be developed.

Though it is acknowledged that genetics are likely to play an important role in the development of Emotional Intelligence, Meany (2001) argued that gene expression itself is shaped by the social and emotional experiences of the individual and therefore it can be inferred that EI competencies can be learnt. Supporting the views of Meany (2001), Goleman (2000) pin-pointed, despite the fact that the amount of control one can have on emotions is a genetic component, one can always learn to control one's emotions to a certain degree and therefore EI is learnable. He highlighted that our level of Emotional Intelligence is not fixed genetically. According to him, Emotional Intelligence seems to be largely learnt, and it continues to develop as one goes through life and learns from his/her experiences. In fact, studies that have tracked people's level of Emotional Intelligence through the



years show that people get better and better in these capabilities as they grow more adept at handling their own emotions and impulses, at motivating themselves and at honing their empathy and social adroitness.

Having worked on a similar research pertinent to EI, Bar-on (2000) has found that older cohorts tend to score higher on the scale of EI, suggesting that to some extent, EI may be learnt through life experiences. However, it is argued that without sustained effort and attention, individuals are unlikely to improve greatly.

The findings of Le'Doux (1996) also indicate that while there are stable individual differences in activation patterns in the central circuitry of emotion, there is also pronounced agility. He draws attention to a research on "Mindfulness Training" – an emotional self-regulation strategy – in order to reveal that training can alter the brain centres that regulate the negative and positive emotions. Research and development scientists from a Bio-tech firm who received training to improve Emotional Intelligence competencies expressed that they experienced less stress and that they felt more creative and enthusiastic about their work after attending the training programme. In corporate offices, the inclusion of EI in training programs has helped employees co-operate better and motivate more, thereby increasing productivity and profits (Davidson and Kabat-Zinn, 2003).

These apart, new findings in the field of affective neuro-science have begun to demonstrate that the brain circuitry of emotion exhibits a fair degree of plasticity, both during childhood and adulthood. Supporting the fact EI competencies are learnable, the researchers have rightly pointed that many parents and educators alarmed by increasing levels of conflict in young school children – from low self-esteem to early drug and alcohol use to depression, are yearning to teach their children and students respectively, the skills necessary for Emotional Intelligence in order to combat the repercussions (Davidson et al., 2000).

While the evidence that people can improve on Emotional Intelligence competencies comes from a wide range of sources, the most persuasive evidence is from a longitudinal study conducted at Weatherland School of Management at Case Western Reserve University. The results of this research have made known that Emotional Intelligence competencies can be significantly improved and moreover, these improvements are sustainable over time if put into practice regularly (Boyatzis et al., 1995).

Thus the plentiful available research studies and wide range of findings from the field of psychotherapy (Barlow, 1985), training programs (Marrow et al., 1997) and executive education (Boyatzis et al., 1995) provide evidence for people's ability to improve their EI competencies but with unremitting effort and a systematic program.

While all these research findings serve to support the perception that EI competencies can be either learnt or developed, additional evaluation studies need to be welcomed to ascertain the notion. However, considering the prevailing view that EI can be learnt or enhanced, it is important to comprehend the potent avenues for developing the same.

#### **How can EI competencies be developed/ enhanced?**

Scientific research, in particular on how the brain works, indicates that the formation of emotional skills is much easier in the formative years from birth to the late teens. It is identified that though

infants, children and adults can develop their social and emotional understanding alike, the earlier a person learns the socio-emotional learning process, the greater are the advantages. Thus, it is certainly felt that parents and teachers can bring a radical change in enhancing Emotional Intelligence in children and youth. (<http://www.connected.org/learn/school.html>)

Parents must necessarily guide and support their young children to become emotionally literate by increasing their child's self awareness; teaching them to manage their emotions; calling attention to norms for acceptable behaviour; coaching them to control their negative impulses and helping them to develop listening and communication skills. These apart, parents also need to involve themselves as role models to enable their children become emotionally literate. Parents of elementary-school children must focus on helping them learn to understand different viewpoints and master conflict resolution skills. Those parenting adolescents should model honest and authentic emotional communication in their relationships with their teens. In addition, parents need to encourage independence and autonomy in their children while providing the security, warmth, and closeness to nurture their optimal emotional development.

([http://www.newhorizons.org/strategies/emotional/front\\_emotional.htm](http://www.newhorizons.org/strategies/emotional/front_emotional.htm)).

Among the several research findings that augment the above statement, a research study by Gottman (1997) has confirmed that children who have been emotionally coached by parents have better physical health and score higher academically than children whose parents don't offer such guidance. These children were also identified to get along better with friends, have fewer behaviour problems and be less prone to acts of violence. Nevertheless, children who are emotionally coached still get sad, angry or get scared under difficult circumstances but they are better able to soothe themselves, bounce back from distress and carry on with productive activities. Succinctly, emotional coaching offers children the proven buffer against emotional traumas.

It is also interesting to note that emotionally intelligent parents are at an advantage of raising emotionally intelligent children. This is because of the fact that emotionally intelligent parents are not only aware of children's feelings, but are also at the same time, able to empathize and guide them. Undeniably, emotionally intelligent parents have children who are affectionate; less tensed; better at handling their feelings; more effective at calming themselves; more popular with peers and are rated as more socially skilled by their teachers. Indeed, they are observed to have a longer attention span and thereby tend to become effective learners. Thus, it is envisaged that children who learn most lessons about emotions (the ability to control impulses, delay gratification, motivate themselves, read other people's social cues and cope with life's ups and downs) from their emotionally intelligent parents tend to successfully become more emotionally intelligent (Goleman, 1995).

Apart from parents, the other most promising area of EI practice is schools. Certainly, introducing emotions in schools would bring a radical change in enhancing emotional intelligence in children. Teachers through adoption of the following approaches can help their students develop their EI. Teachers can seek positive outcome in their students by looking for ways that technology can enhance and jump start discussions in classrooms on socio-emotional competencies; be alert to teachable moments that occur naturally in the classroom; create reflections of emotional competency building in the classroom and encourage students to keep a journal which will allow them to be more reflective about their emotional self. Above all, it is imperative that they value emotional



intelligence in their students as highly as they value their cognitive development. In order to enhance emotional intelligence in children, it is vital that teachers too exhibit pro-social and emotionally intelligent behavior to their students. It was found that in schools where the Head Teacher used a more emotionally intelligent leadership style, higher was the academic achievement of the students. In a recent evaluation of the Atlanta-based Resolving Conflict Creatively (RCCP), a multi-school project which has EI learning techniques at the core of its pedagogy, there was generally less school violence, increased self-esteem, improved abilities to help others, and greater personal responsibility for resolving conflicts among participants. (<http://www.aboutourkids.org/aboutour/articles/social-emotional.html>)

The Collaborative Research for the Advancement of Social Emotional Learning ([www.CASEL.org](http://www.CASEL.org)) has collected an extensive database of research on this subject and they have concluded that EI training improves students' relationships to school, which in turn improves their academic performance. The research confirms that students who learn effective social and emotional skills also have less risk of violence or suicide. In a pilot study of one of the pioneering EI curricula, Self-Science, 100 per cent of the teachers reported that the program increases cooperation and improves classroom relationships. They agreed (92%) that the program helped to increase student focus/attention and improved teacher/student relationships ([www.self-science.com](http://www.self-science.com).)

Having identified supportive evidence for the fact that EI competencies can be enhanced, it becomes inevitable for researchers to garner more information on the impact of EI in order to make human life more productive and fulfilling.

#### **What are the significant implications of Emotional Intelligence?**

Highlighting the positive and remarkable impact of EI, Emotional Intelligence lends itself to better personality grooming as researchers have concluded that people who manage their feelings and emotions well and deal with others effectively are more likely to lead contented lives. High emotional intelligence thereby leads to effective self management and effective relationship management, which in turn lead to personal success (<http://www.emotionalintelligence.co.uk/>). Researchers have also found that emotional awareness enhances the ability to handle feelings in all walks of life, including family relationships. (Schutte et al., 1998). Moreover, EI improves one's well-being and achievement and enables one to manage moods, recover from setbacks and build supportive relationships. It helps individuals make good choices, defer gratification in the interests of long-term goals, and work effectively with others. ([http://www.dukegiftedletter.com/articles/vol2no2\\_feature.html](http://www.dukegiftedletter.com/articles/vol2no2_feature.html)).

Also, people with higher Emotional Intelligence are more satisfied with their social networks; are likely to have better social support; have fewer problematic interactions with others; seem to be more successful at avoiding interpersonal arguments and fights; are better able to resolve personal conflicts; have lower levels of aggression and are less likely to abuse drugs and alcohol. (Mayer et al., 2004). No doubt, EI is a highly desirable and personally valuable attribute to possess.

Currently, there is also an immense interest in EI in the scholastic and employment environment across almost all nations. As regards academics, research in brain-based learning suggests that emotional health is fundamental to effective learning. According to a report from the National Centre for Clinical Infant Programs, the most critical element for a student's success in school is an

understanding of how to learn. The key ingredients for this understanding are - confidence, curiosity, intentionality, self-control, relatedness, capacity to communicate, ability to co-operate - traits that are all components of EI. The report reiterates that a student who learns to learn is more likely to succeed than a student who fails to learn to learn. Also, skills such as delaying satisfaction or enjoyment when aspiring for long-term goals are helpful to children academically. Children who can stick with tasks and finish homework or assignments do much better in later life than those children who are easily distracted and go off to do something else (Williams and Sternberg, 1998).

In the corporate sector, researchers (Ashforth and Humphrey, 1995) have investigated dimensions of EI by measuring social skills, interpersonal competence, psychological maturity and emotional awareness. Social scientists have uncovered the relationship of positive EI phenomenon like leadership qualities, group performance, individual performance, interpersonal relations, and resilience to change with success in work place. Singh (2006) too communicated that Emotional Intelligence matters as much as technical and analytical skill combined. He affirmed that Emotional Intelligence becomes crucial for better performance and for climbing up the ladder in the competitive corporate world.

Research findings from Hay/McBer Research and Innovation (1997) reveal that sales representatives at a computer company, hired based on their emotional competence were 90 per cent more likely to finish their training than those hired on other criteria. Financial advisors at American Express whose managers completed the Emotional Competence Training Program were compared to an equal number whose managers had not undergone the training. During the year following training, the advisors of trained managers grew their businesses by 18.1% as compared to 16.2% for those whose managers were untrained.

At L'Oreal, sales agents selected on the basis of certain emotional competencies added an annual net revenue increase of \$2,558,360 (Spencer & Spencer, 1993; Spencer et al., 1997). The US Air Force saved \$2.7 million in recruiting costs by using an EI profile (Handley, 1999). A year-long EI initiative at the Sheraton Studio City in Orlando helped improve guest satisfaction, reduce turnover, and boost market share by 24% (Fredman, 2003). Laconically, the above stated statistics and data accentuate the fact that possession of EI competencies can bring about noteworthy outcomes. Scientists have also identified that some patterns like fear and worry, negative self-image and unrealistic expectations block the use of a person's Emotional Intelligence and in situations where Emotional Intelligence were not used, people ended up acting in unsuccessful ways (Goleman, 1995). Certainly, EI, the skill that help to harmonize, is becoming an increasingly important pedagogic and workplace asset in the contemporary society.

From the above explanations it is evident that EI is vital, leading to significant gains in productivity in one's life. While the above research findings flash insights on the significance of EI, the speculation continues to prevail.....

### **Is Emotional Intelligence the single predictor of success in life?**

The answer to this question is both positive and negative supported by pertinent evidences. Several scientists have agreed that EI has proven itself to be a better predictor of future success than the traditional methods like the standardized intelligence test scores. In fact, for many years, it was thought that a person's Intelligence Quotient (IQ) determined one's success in life. With the



assumption that IQ predicts academic success, many schools, in the past used IQ tests to choose children for gifted programs and some companies even used IQ scores while hiring employees. However, of late, it has become an established fact that the Emotional Intelligence of a child determines 80% of his success and fulfillment and his IQ determines at best about 20% ([http://www.ashakiran.net/ar\\_01.htm](http://www.ashakiran.net/ar_01.htm)). Despite quite a number of old researches having demonstrated that IQ is linked to completion of high school, attainment of higher education and avoidance of criminal conviction, there are little conclusive evidences and proof that only IQ predicts the outcome. It is strongly felt that though IQ will continue to remain a significant predictor of 'choice of work', especially in foreseeing which job, profession or career path a person can follow, when it comes to the question of whether the person will become a 'star performer' within that role or be an efficient leader, IQ may be a less powerful predictor than Emotional Intelligence (Goleman, 2002).

Smith (2002) asserted that psychologists too believe that traditional measures of intelligence, such as Intelligence Quotient (IQ) test, fail to fully explain cognitive ability, as they do not take into account the emotional abilities. They opine that although traditional methods of intelligence testing provide some degree of predictive validity, they have not been able to account for larger portion of the variance in academic accomplishments, career/work performance and success in life.

These apart, qualitative researches too augment the fact that IQ measures fail to justify inconsistency related to performance and career success, especially among top managers and senior leaders (Araoz, 2001). Indeed a large body of research on top performers (Spencer and Spencer, 1993) reveals that IQ does not contribute to success as other competencies that integrate cognitive, emotional and social abilities are becoming more important. Understandably, of late, Human Resource Managers in charge of hiring/ recruiting and employers offering a promotion to their employees are far more interested in Emotional Intelligence (assessing capabilities related to outstanding performance and leadership) than IQ.

In a large beverage firm, using standard methods to hire employees, 50 per cent left within two years, mostly because of poor performance. When they started selecting based on emotional competencies such as initiative, self-confidence, and leadership, only six per cent left in two years. Research by the Center for Creative Leadership has found that the primary causes of derailment in executives include difficulty in handling change, not being able to work well in a team and poor interpersonal relations – all indicating deficits in emotional competence (McClelland, 1999).

Goleman (1995) emphasizes that Emotional Intelligence is the major and most important predictor of grades, promotions, health and relationship quality. According to him, it is acknowledged that 'Emotional Intelligence' is more important than IQ when it comes to people skills. He had stressed that IQ contributes about 20 per cent to the factors that determine life accomplishments and leaves about 80 per cent to Emotional intelligence. He also quotes research evidences to support his view. Boys in grade II who are impulsive and always getting into trouble are six to eight times more likely than other children to be violent in their teens and commit crime. Sixth grade girls who confuse feelings of boredom and anger with hunger are the most likely to have eating disorders when they become teenagers. The above statement indicates that these children are unaware of how they are feeling. Thus, it is interpreted that if a person does not have the EI skills, he or she can get into trouble, especially during transition from childhood to adulthood whereas if a person has EI skills, he/she can help himself/ herself throughout life (O' Neil, 1996).

As regards work force too, in jobs of medium complexity (sales clerks, mechanics), a top performer is 12 times more productive than those at the bottom and 85 percent more productive than an average performer. In the most complex jobs (insurance salespeople, account managers), a top performer is 127 per cent more productive than an average performer (Hunter, 1990). Software developers with high levels of Emotional Intelligence can develop effective software three times faster than others and sales consultants with high levels of Emotional Intelligence generate twice the revenue of their colleagues

(<http://www.haygroup.com/tl/EI/Default.aspx?clid=CPr7pOA3lwCFQu2bgodrnlyEA#Impact>).

These apart, competency research in over 200 companies and organizations worldwide suggested that about one-third of this difference in performance is due to technical skill and cognitive ability while two-thirds is due to emotional competence (Goleman, 1998).

Ironically, the excitement generated in the popular media and the heightened focus on EI has often left us with the impression that high EI scores might somehow compensate for a low IQ i.e allow those below average IQ, but with high emotional intelligence, to thrive despite below average intelligence. In essence, it gives a false impression that IQ matters little. While the consensus is that Emotional Intelligence is clearly an important construct to predict success, it is indispensable to acknowledge that by expanding the prevailing definition of intelligence, we can obtain a more realistic and valid assessment of factors that lead to personal effectiveness and adaptation (Sternberg, 1997).

Cherniss (2001) looks at the same issue from a different perspective. He surmises that the issue of separating abilities related to cognitive intelligence from abilities, traits and competencies related to Emotional Intelligence remains a complex one, as all definitions of Emotional Intelligence represent a combination of cognitive and emotional abilities. This reflects the growing understanding in neuroscience that cognition (IQ) and emotions (EI) are interwoven in mental life rather than existing discretely independent, especially in complex decision making, self-awareness, affective self-regulation, motivation, empathy and interpersonal functioning. In brief, it is inferred that the distinction between intelligence and knowledge in the area of cognition is very clear. However, in that area of cognition, the distinction between intelligence and emotion is murky. Recker (2005) too believes that both types of intelligence are important but in different ways. He acknowledged that in the last 10 years, researches have identified that IQ coupled with EI is a pre-requisite for person's success in life.

While research on Emotional Intelligence has progressed significantly since its inception, longitudinal research looking at the relative contribution of IQ and specific theoretical constructs within the Emotional Intelligence paradigm would help better clarify the comparative importance of each. In short, more research will be needed to further validate claims of combined or relative importance that EI and IQ hold to the prediction of specific criterion - Success.



## CONCLUSION

Through dichotomous thinking of many researchers and through several researches, quite some issues pertinent to Emotional Intelligence have been brought to the limelight through this review paper. It is assumed that these issues hold importance to the field of Emotional Intelligence and at the same time call for more thought, study and research in this particular area. Given the current state of affairs and emerging trends, it is suggested that the concerned delve deeper into this subject matter such that it would provide more clarity on facts significant to the understanding of the concept of Emotional Intelligence.

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**NUTRITION EDUCATION: ROLE OF SOCIAL MARKETING****Deepa Prakash and Jamuna Prakash**Department of Studies in Food Science and Nutrition,  
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Education about nutrition can be used to address multifaceted problems and as a tool to effect behavioural change in population. Social marketing is a process by which commercial marketing techniques and principles are used to plan, implement, and evaluate programs designed to bring about change in health or social behaviors. Social communication intervention in nutrition can be interpreted as a set of communication activities, which aim at a voluntary modification of behaviors that would positively affect nutrition status. This paper describes the positive role of social marketing in nutrition education with examples of successful case studies in smaller communities and on a wider scale in India and China.

**KEY WORDS:** Community, public health, dietary behaviour, fortification, micronutrient deficiency

"Positive health requires knowledge of man's primary constitution (which today we call genetics) and the powers of various foods, both those natural to them and those resulting from human skill (today's processed foods)" - 480 BC, Ancient Olympia, Greece. Even in ancient times health was an excellence in its own right, the physical counterpart and condition of mental activation. The details of the regimen practiced for health were an important part of Greek medicine. The interaction between genetic and environmental factors influences human development and is the foundation for health and disease. Genetic factors define susceptibility to disease and environmental factors determine which genetically susceptible individuals will be affected. Nutrition and physical activity are the two most important environmental factors in maintaining health and well being. Genetic variation influences the response to diet. Nutrients and physical activity influence gene expression. Because of differences in gene frequency, dietary habits and activity levels, universal dietary and physical activity recommendations are not appropriate. Instead knowledge on diet and exercise should be a guide for health and prevention of diseases. (Simopoulos and Pavlou, 2001).

Education is an integral part of life and a potent social leveler. Education gives people a sense of control over their lives and future orientation that encourages investment in the future, such as saving up for old age (Davis, 2000, Ippolito, 2002). It fosters lifelong learning and socialization of children into active citizens. It clearly promotes higher standards of health when girls as well as boys are educated (Caldwell, 1993). It promotes economic well being of society (Worsley, 2005).

Education about nutrition and physical activity needs to be adapted to each country and to different populations and cultures. Education about the beneficial physical and psychological effects of proper nutrition and physical activity in health and disease needs to be directed at all age groups – children, adults, and the elderly. Education needs to address the detrimental effects of sedentary life-styles, under nutrition and malnutrition, in particular for children. Education should reach people through various channels – the mass media, print, television, and radio – at worksites, and in the community in order to reach everybody in the population. Another means to achieve education would be through



role models in the family, schools, sports, and entertainment. Institutions such as schools can set examples for proper nutrition and physical activity. The food and sports foods industry needs to be cognizant of the scientific evidence regarding optimal nutrition and physical activity levels (Simopoulous and Pavlou, 2001).

### **Social Marketing and Nutrition Education**

Marketing is typically seen as the task of creating, promoting, and delivering goods and services to consumers and businesses (Kotler, 2003). According to Kotler (2003), it's questionable if the marketing concept is as such an appropriate philosophy in an age where health of the consumers and the environment goes largely unaddressed and often leads to destroying both. Kotler considered the following criticism to explain the same "The fast food hamburger industry offers tasty but unhealthy food. The hamburgers have high fat content, and the restaurants promote fries and pies, two products high in starch and fat. The products are wrapped in convenient packaging, which leads to much waste. In satisfying consumer wants, these restaurants may be hurting consumer health and causing environmental problems". Keeping the problem in mind, a more humanistic and ecologically sound aim in marketing was made hence creating the concept of social marketing.

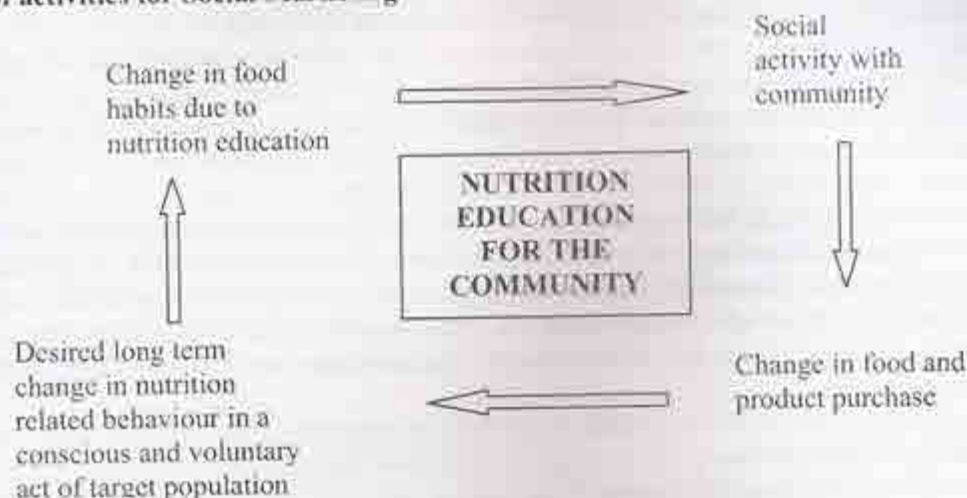
Social marketing is a process by which commercial marketing techniques and principles are used to plan, implement, and evaluate programs designed to bring about change in health or social behaviors. It employs mass media and social systems often called "channels" to reach larger number of individuals and attends to social communication, social mobilization and media advocacy to result in community development, partnership and systems change (Snow and Benedict, 2003).

In 1985, Hornik, in a review written for the ACC/SCN (the United Nations Sub-committee on Nutrition) that has become a classic, showed how nutrition education as it was practiced at the time, was inefficient, and he gave reasons therefore. During the following ten years or so attempts were made to develop new approaches. Manoff, (1985) introduced and developed "social marketing" for nutrition.

The departure point was the simple and common observation that people continuously exchange information that contributes to shaping their behaviour: mothers about feeding their child, diabetics about diet or secondary complications of their disease. They use to this effect a variety of means, verbal or non verbal, and transmit messages through a variety of channels. They, maybe more importantly, pass to each other beliefs, values, attitudes, that help individuals to become or remain members of a group, thereby guaranteeing the group's cohesiveness and that underlies many aspects of behaviour, including those related to food and nutrition. In order to change practices one needs to interfere with existing social communication process, filtering out what is not favourable for nutrition and providing sound information – and at the same time respect both people's freedom to decide by themselves and their right to resist change. The question is less to modify individual behaviour than to help groups, which are confronted with a nutrition problem to become conscious of it, and seek together how to deal with it (Beghin and Andrien, 2003).

According to Hornik (1985), social communication intervention in nutrition can be defined as "a set of communication activities which aim at a voluntary modification of behaviors that would positively affect nutritional status".

## Flow of activities for Social Marketing in Nutrition Education



Beghin (1995) emphasises from the start two underlying assumptions: the need for comprehensiveness and a belief in genuine participation. Comprehensiveness consists in approaching the intervention as a part of a whole; in the view of the author no intervention in social communication should be considered in isolation. Participation is justified on two independent grounds. Firstly, it increases the intervention's effectiveness thanks to better relevance, acceptability, and sustainability. Secondly one can take as a goal in itself granting people the right to know and to participate in decisions that might influence their lives.

Achieving behaviour change is a complex process, influenced by a large number of factors extraneous to the communication strategy. However, there is no doubt that certain characteristics of the messenger as well as some features of the message itself and its delivery are crucial to success (Warnasuriya, 2003). Ideally, the designing and delivery of a nutrition message should be done in a participatory manner with the target community being involved from the earliest stages (Anderson, 1988). What prevails often is the so called "top down" approach with some modification (Tontisirin and Gillespie, 1999).

Hornik (1985) established three sequential conditions for nutrition education:

1. The need to show that there is potential for nutrition education. We must show either (a) the currently available resources at the house hold level are not producing optimal nutritional benefit, i.e., if people made better use of their current income they would be better fed, or (b) that concurrent or coming changes in the environment could allow better nutritional status if people knew how to adapt to those changes. If (a) can be established it would be consistent with a nutrition education program standing alone. If only (b) can be established, then only nutrition education program introduced in the context of naturally occurring or planned complementary changes can be justified.
2. We need to show that educational interventions can bring about desirable change in behaviour and nutritional status. Establishing that there exist materially feasible changes in the behaviour, which are nutritionally beneficial is not the same as saying that a particular



educational intervention can affect those changes. We need to show that educational interventions have resulted in improved nutritional status.

3. Finally, we need to show that effective education can be realized on a scale that will allow a large number of people to benefit. Of the three necessary conditions, this is the most difficult to establish. The inverse relation between effectiveness and scale, and way to address that dilemma, will be major themes.

According to Hornik, (1985) most observers feel that there is a very large and important category of nutritional problems against which nutrition education cannot do very much: such as those attributable to poverty. Hornik points out that recent research seems to suggest that even the poor are influenced much more by matters of taste and status than by the nutritional considerations in deciding upon the additional food they will consume. The problems are primarily ones involving behavior within the family.

### **Social Marketing in Community**

Nutrition communication aimed at changing dietary behavior to alleviate micronutrient deficiency in communities requires utilization of all components of marketing principles that contribute to the communication process (Nayak et al, 2001). In view of the widespread prevalence of vitamin A deficiency in India and its public health significance, the National Nutrition Policy, set goals to eliminate blindness attributable to lack of vitamin A.

Nayak et al, (2001) studied the operational feasibility of adopting a social – marketing approach to develop a community program of nutrition communication to promote consumption of vitamin A rich foods. Five comparable villages in a developmentally backward and drought-prone district in southern India were selected. In two experimental villages, social-marketing strategy was adopted for nutrition communication, while conventional nutritional education was implemented in two positive control villages. A large village did not receive any intervention and served as the negative control. Intervention programs were carried out in the study areas for a period over one year. The results indicated that the knowledge, attitude and practices among mothers of pre-school children about Vitamin A improved significantly in the experimental area after intervention. There was a four-fold increase in the intake of vitamin A rich foods among pre-school children in the experimental area, as compared with a twofold increase in the positive control. There was no change in the negative control area. There was a significant decrease in the prevalence of Bitot's spots after intervention in the experimental area ( $P \leq 0.05$ ). There was no change in the other two areas. The study demonstrated the effectiveness of a social-marketing strategy for nutrition communication for the prevention and control of micronutrient deficiencies and the need for adopting innovative strategies for communicating nutrient messages.

Some studies have explored the effects of parents' nutrition knowledge on their children's knowledge and dietary practices. Contento et al. (1993) found that Latino mothers' nutrition knowledge and attitudes toward nutrition were positively correlated with nutrient intakes of their 4- to 5-year-old children. Kirks et al, (1982) found that involving parents in a nutrition education program for primary-grade students increased the diversity and quality of students' diets. Furthermore, a 5-year follow-up with the same students showed that they continued to eat a better quality diet than students

whose parents had not participated in the original nutrition education intervention (Kirks and Hughes, 1986). Thus parental involvement appeared to increase the family's overall nutrition knowledge as well as the likelihood that nutrition information would be integrated into family food-shopping and food-preparation practices.

Compared with other children, those from families whose mothers considered healthfulness as an important criterion for selecting foods consumed diets significantly lower in calories, fat, saturated fat, and sucrose and higher in fiber and vitamin A (Contento et al, 1993). Oliveria et al (1992), examining the relationship between nutrient intakes of parents and their 3- to 5-year-old children participating in the Framingham Children's study, found a modest but significant association between parents' and children's intakes for most nutrients. The association was stronger between mothers and children than fathers and children, and the strength of the association increased with the number of meals parents consumed at home.

In Micronesia, a campaign to promote the drinking of green coconut water instead of imported and expensive soft drinks was initiated and carried out for two years by the Yap District Health Department (Rody, 1978). Yap District is a group of 17 inhabited islands. The project used a comic book, in-store posters and some direct lobbying to encourage stores to stock and people to buy "drinking coconuts". The only newspapers on the island published a photograph of coconuts with a caption that indicated they were the "real thing" and a well-known soft drink the artificial thing. Most young Yapese adults are literate and the slogans soon became popular catch phrases around the district, according to the evaluator. Also a series of cartoons, not originated by the nutrition project, appeared in the paper showing a canned soft drink representing unpopular foreign influence and a coconut character representing Yapese sentiment. Arrangements were made to assure local stores an adequate coconut supply (Hornik, 1985).

As a result of the campaign, most stores on the four main islands began keeping cold coconuts in their refrigerators and selling them for half the price of soft drinks. Several individual stores reported average sales of 1000 coconuts weekly per store on the main island, even though the total population is less than 4000. Based on district tax receipts, imports of soft drinks to Yap decreased to less than half their previous level after the campaign (Rody, 1978).

Hornik (1985) also studied a small scale program conducted by the Community Systems Foundation (1976) in Colombia and was directed toward educating communities to increase the utilization of soy protein in local diets. They opened small self-supporting shops, a "tombolita", that was staffed by local women who prepared and sold soy products like milk and cheese.

The women also conducted regular in-store and in-home educating. A survey found that 60% of the families in the test city, Villa Rica, had received instruction in soy utilization. A store survey found that of the 37 stores in Villa Rica, seven were selling soy and a millet in quantities sufficient to close the average protein gap in the community by 10% (Hornik, 1985).

Wright (1982) conducted a social marketing experiment in two Brazilian villages. In either village they distributed soy bean for free thereafter for the next four months they made soybean available locally at a subsidized price. In both villages, education programs were conducted, both in groups as well as individually. Before the onset of the program, none of the women reported soybean in their



24-hour recall. However, after the program 25% of the women reported use of soybean in their 24 hour recall. During the time soybean was distributed for free 50% of the women had reported consumption of soybean in their 24-hour recall.

The University of North Carolina School of public health worked with the Bolivian Ministry of Health and USAID scholarship, mounted an 18-month campaign to increase the use of soybean in rural Bolivia. Soybeans were not previously consumed. The program made use of radio (one 15-minute program and 6-10 jingles per day) and an extensive program for cooking method demonstrations in target villages (Hornik, 1985).

Evaluation information at the end of the program suggested that information levels about soybeans were high, over 80% of the population had tried them, 45% had cooked and consumed them at home. This social marketing however was ineffective as after the campaign the investigators found only 2.5% of the population had reported soybean consumption in their 24 hour dietary recall. According to Hornik, (1985) the investigators attributed the failure to the relatively difficult cooking operation in soybeans and complicated procedures like having to soak the beans on the previous day in ash water and boiling them.

Large-scale social marketing programs have been undertaken on behalf of a variety of synthesized foods – most notably *Incaparina*, an umbrella term for various mixtures of vegetable protein, originally developed by the Institute of Nutrition in Central America and Panama (INCAP) (Wise, 1980). It was developed as a low cost substitute for milk products. Incaparina achieved significant sales in Guatemala and in related versions in many other countries. The impact was rather minimal among the malnourished, more so since the cost of the product was beyond their resources, even though it was cheaper than milk.

### **Social Marketing: Case Studies, India and China**

Iodine Deficiency Disorder (IDD) is the world's leading cause of mental disorders, including retardation and low Intelligence Quotient (IQ). Research indicates that 30% of the world's population is at risk for IDD. Well balanced diets provide the required amounts of iodine, making the poor particularly susceptible to IDD (Prahald, 2005). The Economic Intelligence Unit, Country Indicators, 2003 indicate that in India almost 90% of the population earns less than \$3000 per year. According to the International Council of Iodine Deficiency Disorder, 2002, more than 70 million Indians are already inflicted with IDD and another 200 million are at risk. India's Universal Salt Iodization law mandated that all salt manufacturers add at least 15 ppm of iodine to edible salt. Although a few manufacturers voluntarily added iodine, most uneducated consumers continued to purchase the lower priced uniodised salt, perpetuating IDD (Prahald, 2005).

Unilever's Indian segment, Hindustan Lever Limited (HLL) launched in various sub-brands iodised salt to the entire spectrum of the Indian population – from the upper income segment right down to the population at the bottom of the pyramid (BOP). Advertisements were the basic tool of communication to the customer. The HLL salt team believed all mothers are motivated by the same dreams of bright, healthy children. All of Annapurna's advertisements convey this message. During the 2001 launch of Annapurna with their proprietary stable iodine K15 technology, HLL aired a puppet show about IDD on Doordarshan, an Indian government run TV network. The infomercial was extremely successful, winning awards from Unilever for its effectiveness in delivering a

admirable message. According to HLL market analysis, the target group viewed the advertisement an average of 4 times. Although the long-term retention is unknown, the immediate recollection of the message was 90% (Prahlad, 2005).

The nutritional status of a population is one of the factors that significantly affect its health and productivity and consequently the economic development of the community. Among the nutritional deficiencies, iron deficiency is a global nutritional problem, especially in the developing countries. The main explanation for this deficiency is the low bio-availability of dietary iron in the plant-based diets that are typically consumed in many developing countries. Iron deficiency reduces mental development in infants and cognitive capacity in schoolchildren (Lozoff and Wachs, 2001) and decreases immune system capability and working capacity in adults. It also adversely affects pregnancy outcomes, producing, for example, increased maternal morbidity and mortality, premature delivery and low birth weight of infants (Micronutrient Initiative, 2000).

The Chinese dietary pattern is predominantly plant based, and even among the general population, consumption of cereals and vegetables is higher than in the diets common in Europe and North America. The bio-availability of iron in a regular Chinese plant-based diet is as low as 2.57 percent, whereas in a diet with 144 g of meat the iron absorption is 10.39 percent (Liu, 1999). Information from a 1992 nationwide nutritional survey indicated anaemia prevalence in all age groups in China. The national average prevalence of anaemia among women was 22.7 percent, while for men it was 14.6 percent (Ge, 1996). According to the nutrition survey carried out in 2000, the prevalence of anaemia among children under the age of five was 12.3 percent in urban areas and 26.7 percent in rural areas.

The economic loss due to anaemia has been calculated based on the method known as PROFILES (Ross, 1999). The PROFILES model assumes a direct relationship between the level of anaemia and adult manual labour productivity. Levin *et al.* (1993) reported that workers with iron deficiency anaemia are less productive in physical tasks than are nonanaemic workers, producing 1.5 percent less output for every 1.0 percent reduction in haemoglobin below standard values. This conclusion is based primarily on the results of a study conducted in Indonesia by Basta *et al.* (1979), but is supported by extensive literature (reviewed by Levin *et al.*, 1993). Ross and Horton (1998) estimate that iron therapy in anaemic adults results in a 5 percent increase in manual labour productivity and an additional 12 percent increase in heavy manual labour productivity.

The implications for educational performance and future productivity of such iron-deficient groups have been reviewed recently by Ross and Horton (1998), who estimate that anaemic children will suffer a 2.5 percent future productivity loss. The technology for fortification was developed in collaboration with Zhenji Soy Sauce Company. It was demonstrated that fortification of soy sauce with NaFeEDTA can easily be integrated into the production line, and that only limited equipment is required (Chunming, 2003).

According to Chunming (2003) the discussions between the public and private sectors on the consumer affordability of the product resulted in encouraging response from the industry. More so since, the cost of NaFeEDTA and the investment necessary for the fortification were minimal, the industry had promised to absorb as much of the cost as possible to keep the price of the product low. The Chinese Condiment Factory Association was the managing body of the factories in this program.



They decided to make a start with pilot factories followed by stepwise expansion as a measure to keep the market for iron-fortified soy sauce development under control, thus ensuring that the low cost and high quality of the product could be maintained.

Communication was an essential component of the fortification program. The message was delivered to the public with focus on the health consequences and cognitive effects of iron deficiency hence making people aware that iron deficiency, even without anaemia, has health and cognitive consequences. Because the iron fortification of soy sauce was not mandatory (as is the iodization of salt in China), both fortified and nonfortified soy sauce was available in the market. The enhancement of demand was therefore extremely important for the success of the program. Preparations for intensive public education were planned. Communication with industry involved mainly the education and training of the workers. The key to achieving wide support for the fortification program was to communicate with the decision-makers and to translate the benefits of iron fortification into economic terms. The application of PROFILES to estimate the economic gains due to reduction of anaemia prevalence was therefore very useful. Messages of this nature made a deep, positive impression on government officers and economists. Continuous education of the public increased the demand for the product.

The Indian population suffers from micronutrient deficiency even in urban segments where food availability is not a concern. Food choices and selection have changed over the decades with more branded fast foods being chosen over the traditional Indian meal. Healthier population translates to better work performance and lower health care expenditure. To influence a selection of a particular food there has to be a channel of communication to convince the consumer to make a specific choice. It is essential to teach better choice within the basket of available foods instead of expensive and inaccessible foods. Social Marketing of better food choices with innovative and effective selections is the need of the hour. To fortify a regular kitchen ingredient is also an effective concept with a large success rate in developing countries.

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## MICROBIAL LOAD OF FRESHLY PREPARED BETEL QUID (PAN) SOLD BY VARIOUS SHOPS AND VENDORS IN CHANDIGARH

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Two different varieties of pan namely whole pan 'sweet' and whole pan 'tobacco', fifteen each, were screened for testing their microbiological quality. It was observed that *Escherichia coli* isolation was 60.5% in sweet pan, 60.8% in pan with tobacco and 67.5% from possible sources of contamination (nails and hands of the shopkeeper, wiping cloth and work surface used for preparation). Amongst the various ingredients, catechu (Katha) and betel leaf samples showed higher counts whereas cardamom and slaked lime (chuna) showed the minimum counts. Out of 100 strains of *Escherichia coli* being tested, minimum sensitivity (26.3%) was shown towards Ampicillin and maximum (96.9%) was noticed towards Gentamycin. A high level of hydrophobicity (96.6%) was found amongst *Escherichia coli* isolates. At the highest concentration of metal ions (100 µg/ml) tested, 5% resistance was shown by *Escherichia coli* strains towards silver nitrate and mercuric chloride whereas at the lowest concentration (20 µg/ml) of metal ions, 88% and 86% strains showed resistance to the respective metal ions. Whole pan 'sweet' also supported the maximum growth of test organisms as compared to whole pan tobacco and nutrient broth.

**KEY WORDS:** betel quid (pan), *Escherichia coli* isolation, Ampicillin sensitivity, Gentamycin sensitivity

The tradition of chewing betel quid, colloquially known as pan, is age old and deeply rooted in India since 8000 years. Even after being ranked fourth amongst widely used drugs, betel quid has a primary role in social ceremonies. Since most of the ingredients of pan are used in raw form without any heat treatment, the risk of bacterial contamination is higher. Generally the shopkeeper, following the unhygienic practices are the main culprits who increase the level of bacterial contamination coming from their own hands, equipments, utensils and dusters which are used commonly while preparing the pan (Davis and Kendall, 2000).

The tradition of betel chewing has long been disastrous for a country like India, which has the world's highest incidence of oral cancer. Indian males tend to use tobacco for the first time when they are as young as eight years old (Amarasena N, 1999).

The present study was thus undertaken to determine the degree of contamination of freshly prepared betel quid, prepared and sold by various shops in Chandigarh.

### MATERIALS AND METHODS

In the present investigation, 15 samples each of sweet pan and pan with tobacco along with the basic ingredients used in their preparation were collected. Sixty swab samples of wiping cloth, work surface, hands and nails of food handlers (15 each) were also collected in sterile conditions and examined.

The viable count in the desired dilution was determined by the standard plate count technique by using nutrient agar as growth medium for total counts and McConkey's agar for gram negative counts. For isolation of *Escherichia coli* from the swab samples the swabs were streaked on McConkey's Agar and dark pink, non-mucoid, lactose fermenting colonies were streaked on Eosin Methylene Blue (EMB) agar. The colonies showing characteristic metallic green sheen of



*Escherichia coli* were picked up. The isolates were characterized by various biochemical tests (indole red test, Voges-proskauer, methyl red test and citrate utilization test).

Salt aggregation test (Lyungh and Wadstrom, 1982) was conducted to determine hydrophobicity of *Escherichia coli* isolates. Also, these strains were subjected to varying concentrations of silver nitrate and mercuric chloride to determine the minimum inhibitory concentration towards *Escherichia coli*. Disc diffusion test (Bauer et al, 1996), was employed for determining the sensitivity of the isolates towards five selective antibiotics namely Gentamycin, gatifloxacin ciprofloxacin, nalidixic acid and Ampicillin. Also the correlation between multi-drug resistance and hydrophobicity was calculated by applying Chi-square test.

## RESULTS AND DISCUSSION

The commonly used handling practices and the open environment in which the ingredients of betel quid are kept, play a major role in contaminating it. The results in Table 1 depict the pattern of *Escherichia coli* isolation from various pan samples, their ingredients and possible sources of contamination.

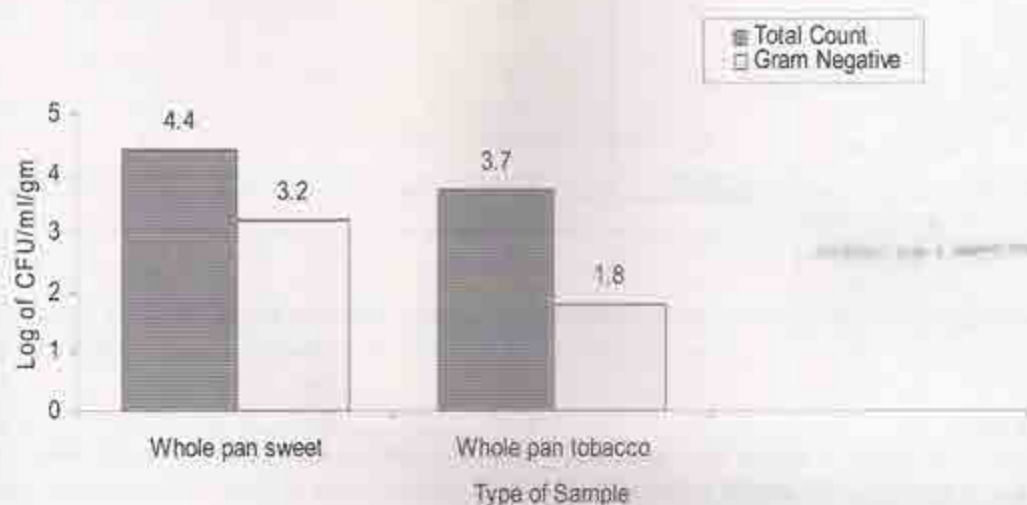
**TABLE 1: Percentage isolation of *Escherichia coli* from various whole pan 'sweet' and whole pan 'tobacco' samples, their ingredients and sources of contamination**

Sample	Total No. of Samples	No. of <i>Escherichia coli</i> Isolates	Percent isolation of <i>Escherichia coli</i>
<b>Whole Pan Sweet</b>			
1. Pan leaf	15	13	86.6
2. Slaked lime	15	06	40.0
3. Catechu	15	07	46.6
4. Areca Nut	15	08	53.3
5. Gulkand	15	12	80.0
6. Cardamom	15	04	26.6
7. Whole pan	15	14	93.3
<b>Total</b>	<b>105</b>	<b>64</b>	<b>60.5</b>
<b>Whole Pan with 'Tobacco'</b>			
1. Pan leaf	15	11	73.3
2. Slaked lime	15	05	33.3
3. Catechu	15	06	40.0
4. Areca nut	15	08	53.3
5. Tobacco	15	13	86.6
6. Whole pan	15	12	80.0
<b>Total</b>	<b>90</b>	<b>55</b>	<b>60.8</b>
<b>Sources of Contamination</b>			
1. Hands	20	15	75.0
2. Nails	20	09	45.0
3. Wiping cloth	20	17	85.0
4. Work surface	20	13	65.0
<b>Total</b>	<b>80</b>	<b>54</b>	<b>67.50</b>
<b>Grand Total</b>	<b>275</b>	<b>173</b>	<b>62.93</b>

The results in Table I show that *Escherichia coli* isolation was maximum (93.3%) in whole pan 'sweet' and least (26.6%) in cardamom due to its storage in sealed polyethylene packets.

Among the sources of contamination, the maximum isolation (85%) was obtained from wiping cloth used by the shopkeepers. This could be justified because the dirty wet cloth was neither washed with detergent nor put in boiling water for washing by the end of the day. This results in accumulation of dirt and bacteria in the wet cloth which when used for cleaning enhanced the microbial load of the food stuff.

**Fig.1:** Comparison between whole pan sweet and pan with tobacco regarding their total and gram negative counts



A comparison between whole pan 'sweet' and pan with 'tobacco' regarding the total bacterial counts and gram-negative counts is illustrates in Figure 1. The results showed that whole pan 'sweet' samples showed higher counts in both the categories i.e. total and gram-negative counts with a range of  $2.1 \times 10^4$  CFU/gm -  $4.3 \times 10^7$  CFU/gm and  $1.5 \times 10^2$  CFU/gm -  $2.9 \times 10^7$  CFU/gm respectively. Pan with tobacco when tested as whole showed a total count in the range of  $2.8 \times 10^2$  CFU/gm -  $4.1 \times 10^6$  CFU/gm while gram negative count lay between  $1.1 \times 10^2$  CFU/gm and  $2.3 \times 10^5$  CFU/gm counts.

A high level of hydrophobicity (96.6%) was noted for *Escherichia coli* strains isolated from whole pan samples, their ingredients and sources of contamination with 100% isolation from gulkand, whole pan 'sweet', wiping cloth and work surface samples. Such high levels of hydrophobicity allow the organism to contribute to infectious outbreaks (Busscher et al., 1990).



**Table 2: Sensitivity of *Escherichia coli* isolates from whole pan samples their ingredients and various sources of contaminations, towards different antibiotics**

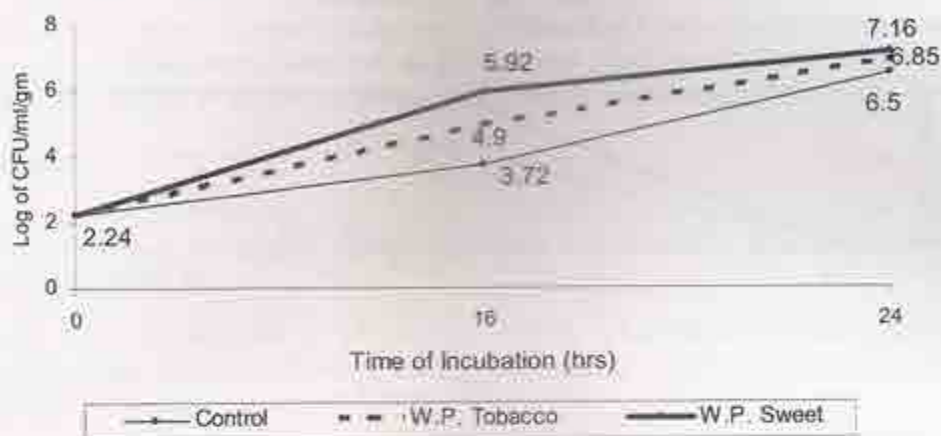
Type of sample	No. of E coli isolates tested upon	Sensitivity Towards				
		Gentamycin 10 µg	Gatifloxacin 5 µg	Ciprofloxacin 5 µg	Nalidixic acid (10 mg)	Ampicillin (30 mcg)
Ingredients						
Panleaf	10	09	08	08	09	02
Arena nut	10	10	09	0	10	03
Tobacco	10	10	10	08	09	02
Grulkand	10	09	10	10	10	04
W.P. Sweet	10	10	10	08	09	01
W.P.tobacco	10	10	09	10	10	02
Total	60	58	56	52	57	14
Percentage		96.6	93.3	86.6	95.0	26.3
Source of contamination						
Hands	10	10	09	09	08	04
Nails	10	10	09	10	09	03
Wiping cloth	10	10	08	07	10	04
Work surface	10	08	09	08	10	02
Total	40	38	35	34	37	13
Percentage		95	87.5	85	92.5	32.5

The results in Table 2 depict the sensitivity of *Escherichia coli* isolates towards five common antibiotics. Out of the 60 strains isolated from whole pan samples and their ingredients, maximum strains (96.6%) were sensitive to Gentamycin, 95% to nalidixic acid, 93.3% to gatifloxacin, 86.6% to ciprofloxacin and only 26.3% to Ampicillin. Similarly in the case of swab samples; 95% isolates were sensitive to Gentamycin, 87.5% to gatifloxacin, 85% to ciprofloxacin, 92.5% to nalidixic acid and only 32.5% to Ampicillin.

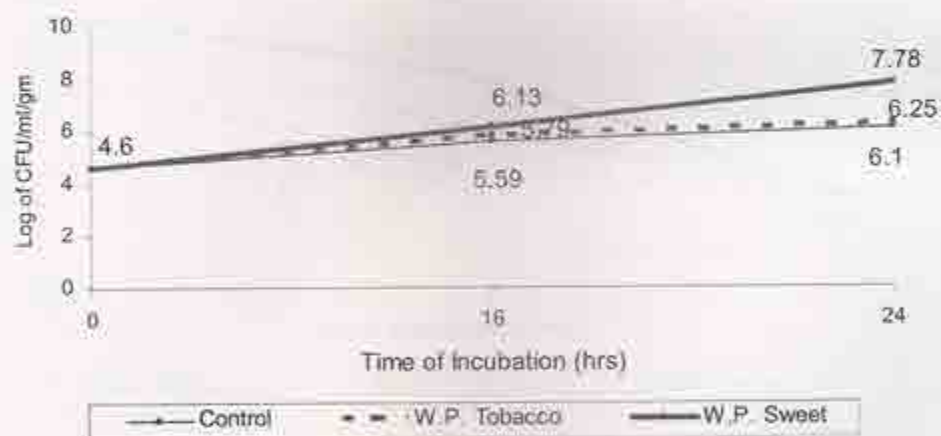
On subjecting 100 strains to metal ion resistance test, an inverse relationship was observed between increasing concentrations of these metal ions i.e. 20, 40, 60, 80 and 100 µg/ml and the percent resistance. Results showed that 88% strains were resistant at 20 µg/ml of AgNO<sub>3</sub> (silver nitrate) and 86% towards same concentration of mercuric chloride (HgCl<sub>2</sub>). At the maximum concentration (100 µg/ml) of the metal ions, 5% strains were resistant to each silver nitrate and mercuric chloride.

The growth pattern of four different organisms namely, *Escherichia coli*, *Streptococcus faecalis*, *Salmonella enteritidis* and *Klebsiella pneumoniae* were studied in whole pan (sweet), whole pan (tobacco) and nutrient broth (control). Figure 2 shows the growth pattern of *Escherichia coli* in whole pan sweet and pan with tobacco. At 16 hours of incubation there was a difference of 2.2 and 1.2 log cycles between whole pan sweet and control and whole pan tobacco and control respectively. At 24 hours whole pan sweet showed higher growth of *Escherichia coli* as compared to nutrient broth (control) (a difference of 4.4 log cycles) followed by nutrient broth and then whole pan tobacco.

**Fig.1: Growth pattern of *Escherichia coli* in whole pan sweet, pan with tobacco and nutrient broth at 0, 16 and 24 hours of incubation at 37°C**

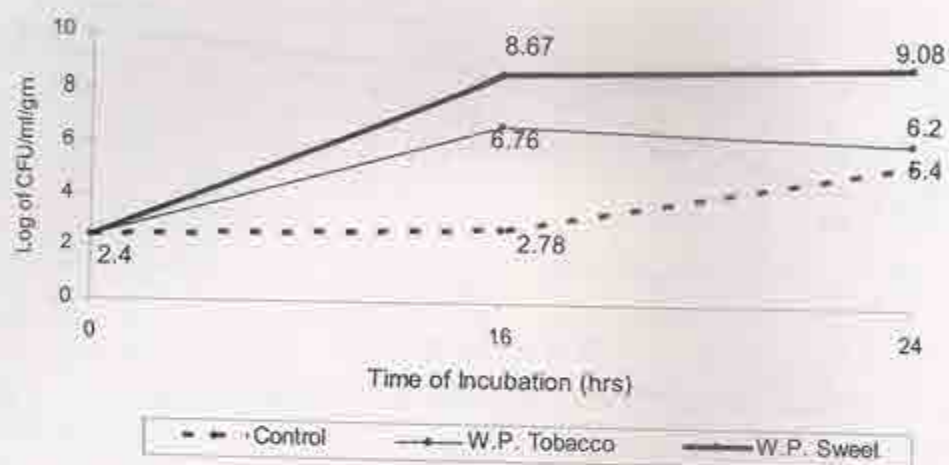


**Fig.2: Growth pattern of *Salmonella enteritidis* in whole pan sweet, pan with tobacco and nutrient broth at 0, 16 and 24 hours of incubation at 37°C**

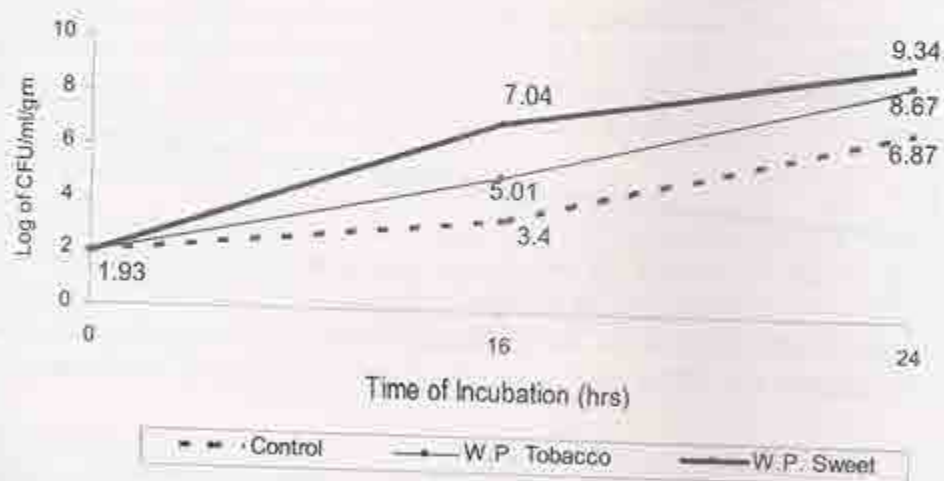




**Fig.3: Growth pattern of *Klebsiella pneumoniae* in whole pan sweet, pan with tobacco and nutrient broth at 0, 16 and 24 hours of incubation at 37°C**



**Fig.4: Growth pattern of *Streptococcus faecalis* in whole pan sweet, pan with tobacco and nutrient broth at 0, 16 and 24 hours of incubation at 37°C**



Similarly results showed that whole pan sweet supported maximum growth of rest of the three organisms whereas whole pan tobacco showed minimum growth of all test organisms across all incubation period.

The present investigation is thus an effort to elucidate the degree of contamination in betel quid (pan), which may undergo contamination at any stage i.e. from fields to transport or from storage to handling. Hence it is equally important to educate and make aware all the people in pan selling business to maintain proper standards of hygiene and cleanliness so that betel quid can still be seen as a sanctified symbol of Indian tradition in future rather than a source of bacterial disease.

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# A COMPARISON OF THE PERFORMANCE OF MENTALLY RETARDED CHILDREN TAUGHT SELF HELP AND CIVIC SKILLS THROUGH TASK ANALYSIS VS THE REGULAR TEACHING PATTERN

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The present study was conducted on twenty moderately mentally retarded children (boys and girls). The selected moderately mentally retarded children were divided into two groups, i.e. Experimental group and Control group. Each group had 10 students (8 boys and 2 girls). Task analysis technique was used for teaching the experimental group. Control group was taught in the regular pattern. Subjects were tested in order to see the progress in the performance on selected skills. Testing was done after 20 days of teaching. Each test was conducted after 30 minutes of revision class. Results indicate that the performance of the children of experimental group was much better than the performance of the control group children. Calculated 't' values were also significant. This shows that task analysis technique, a technique of imparting education can be successfully used for teaching mentally retarded children.

**KEY WORDS:** task analysis, moderately mentally retarded children, regular teaching pattern

People in society can be classified on the basis of their mental abilities which may be average, more than average or less than average. Children having below average mental ability are called mentally retarded.

Mental retardation is the impairment in intelligence from early life or slow mental development during the growth period. Reduced learning ability, lack of social and behavioral adjustments are other characteristics of these children. Such children have difficulty in functional adaptability to the various situations in every day life. Learning problems may persist and even accumulate despite special help by teachers to these types of children. Special education plays an important role in the education of these children. There is a need to make the experiences of the handicapped happier and they can be educated in classroom by special educators by providing extra help in the resource room (Shakespeare, 1975, William et al. 1992 and The World Book Encyclopedia, 1994). To teach them is both rewarding and frustrating (Lyndal 1992).

Mentally retarded children need free and appropriate education to maximize their capabilities. Education should be provided to them, not out of sympathy but as a privilege granted to them. They need special education and related services as a right to develop their capacities to the maximum. According to White and Biller (1988), after attending special education, most students progressed. Children classified as moderately retarded performed at higher levels than what was expected of them.

There are some techniques of special education, which help educators to give education to these types of children. Task analysis is one such technique employed by special educators. Task analysis is the process of sequential analysis of a skill into its teachable components. These components are taught in steps, each step consists of one observable behavior that is taught individually (Moon and Inge 1993).

Thus in task analysis technique students learn more slowly and the teaching material content is broken down into smaller components. The subject progresses step by step mastering each sub skill gradually till he has learnt the entire skill. After each sub skill has been learnt the entire skill is taken as a unit and mastered. It is believed that it is easier to learn small portions at a time rather than the whole unit all-together.

Although task analysis has been known to be superior for imparting education yet this technique is seldom used. Perhaps the reason for this is that it requires a lot of planning, organising and preparing, that is to say the teacher may often spend more time in preparation than teaching and this often discourages him/her from using this technique. This study presents four skills that can be ideally taught using task analysis technique.

## METHOD

### Sample:

The present study was conducted on 20 moderately mentally retarded children out of which 16 were boys and 4 were girls. The I.Q. of these children as available in the records of the special school they attended ranged from 40 to 54 on Weschler's Scale of Intelligence. The chronological age of these children was between 10 to 15 years. They had been studying in the present institute for a minimum period of one year and a maximum period of three years. They were all exposed to similar experiences at least during the last one-year. For the formation of experimental and control group a list of twenty selected students was prepared, every even number student was selected for experimental group and every odd number student was selected for control group. Thus the two groups were formed and each group had ten students of moderate mental retardation.

### Material:

Four activities were taught to them. The material required for teaching each activity is given below—

1. **Shoe polishing:** A pair of shoes, shoe polish, shoes brush and muslin cloth.
2. **Tying shoe laces:** A pair of shoes with laces.
3. **Cleaning the sink:** Sink with a tap, a piece of sponge and detergent powder.
4. **Clearing the dinning table:** Dinning table, tablemat, few utensils and a moist cloth.

### Procedure:

Through task analysis technique two types of skills, self-help and civic skill were taught to the experimental group children. Control group children were taught these skills in their regular pattern. Two activities were taught for the development of each skill.

Self-help skills taught were—

- \* Tying shoelaces
- \* Polishing shoes

Similarly civic skills taught were—

- \* Cleaning the sink
- \* Clearing the dinning table

Each activity was analyzed into its possible steps as suggested by Gearheart (1992).



The steps, which were followed for teaching each skill to experimental group, are given below—

I. Self-help skills:

i. Tying shoelaces:

- a) Criss cross the shoelaces.
- b) Hold right hand side lace put pressure on it and keep it under the left hand side lace.
- c) Lift up the lace with the help of right hand thumb.
- d) Hold both ends of lace in both hands and pull to tighten it.

ii. Polishing shoes:

- a) Clean the shoes with cloth.
- b) Take shoe brush and apply on shoes with it.
- c) Rub the brush evenly on each side of the shoes.
- d) Rub the shoes with soft muslin cloth.

II. Civic Skills:

i. Cleaning the sink:

- a) Wet the sink.
- b) Take detergent powder and spread it on the sink.
- c) Take a sponge and wet it.
- d) Scrub all sides of the sink with the sponge.
- e) Put down the sponge.
- f) Rinse the sink with water.

ii. Clearing the dinning Table:

- a) Collect and pile the bowls together.
- b) Collect and pile the plates together.
- c) Collect and pile the glasses together.
- d) Collect all the spoons in a pile.
- e) Place the piles of bowls, spoons, and glasses on the pile of plates.
- f) Take away this pile from the dinning table and place it near the sink.
- g) Remove the mats on the table (now there is nothing on the table).
- h) Wipe the table with a moist cloth.

Each activity was taught individually to the experimental group and control group. There were a total number of twenty teaching sessions followed by twenty practice sessions. After this period of teaching and practice the subjects were tested to assess difference in performance of the experimental group (taught by task analysis) from control group (taught by regular teaching pattern). The regular teaching pattern followed in the school did not differ significantly from what is followed in the regular schools for normal children. The only difference that was identifiable was excessive repetitions, and the fact that the teacher herself led the group by her demonstrations. Each activity was started and finished in one session. The speed of the activity however was kept controlled considering the disability of children.

The selected subjects were withdrawn from their routine classes for the four activities, which were to be taught. This was done to ensure that the teaching pattern of control group and experimental group were different and that neither group was exposed to the teaching pattern of the

other group. The same procedure was adopted for teaching all the skills. The scoring of their performance on each skill was done as shown in table 1.

**Table 1:** Scoring pattern of performance of children.

S. No.	Assessed Aspects	Marks Assigned			
		0	1	2	3
1.	Uninterrupted task performance	5-4 interrupt	3-2 interrupt	1 interrupt	0 interrupt
2.	Absence of supportive instruction (Sup. Inst)	5-4 Sup.inst	3-2 Sup.inst	1 Sup.inst	0 Sup.inst
3.	Coordinated body action	Poor	Average	Good	Excellent
4.	Clearing work space	Poor	Average	Good	Excellent
5.	Time taken for task completion	Recorded in seconds			

## RESULTS

The two groups, experimental and control groups were taught the four skills and then given practice sessions. Finally, their performance was assessed for each skill separately. The differences in performances of the two groups (experimental and control group) for each of the four skills taught are described in the following section.

**Table – 2:** Differences in the performance of two groups on self-help skill- (Shoe polishing)

S. No.	Assessed Aspects	Experimental Group (N=10)		Control Group (N=10)		Statistical Value	
		Mean	SD	Mean	SD	't'	P
1.	Uninterrupted task performance	2.40	0.49	1.10	0.70	4.810	<0.05
2.	Coordinated body action	1.70	0.78	0.70	0.64	3.134	<0.05
3.	Absence of supportive instruction	2.00	0.77	0.70	0.64	5.021	<0.05
4.	Clearing work space	1.40	0.92	0.30	0.46	3.382	<0.05
5.	Time taken in seconds	352.50	3.04	371.70	29.09	2.076	<0.05

From the table it is clear that the subjects of experimental group have performed better than the control group subjects on all four criteria of assessment of quality of performance. Most significant difference existed in the two groups with regard to the requirement of supportive instruction.

On the basis of the result obtained it can be said that task analysis technique is better than regular teaching procedure for teaching shoe polishing to mentally retarded children.



**Table – 3:** Difference in the performance of two groups on self-help skill- (Tying shoe laces)

S. No.	Assessed Aspects	Experimental Group (N=10)		Control Group (N=10)		Statistical Value	
		Mean	SD	Mean	SD	't'	p
1.	Uninterrupted task performance	0.90	0.83	0.70	0.64	0.603	>0.05
2.	Coordinated body action	0.90	0.54	0.70	0.64	0.755	>0.05
3.	Absence of supportive instruction	0.60	0.49	0.70	0.64	0.392	>0.05
4.	Clearing work space	0.60	0.66	0.50	0.50	0.382	>0.05
5.	Time taken in seconds	40.80	10.39	69.30	6.28	7.424	<0.05

Table 3 presents the mean, SD and 't' value of performance of experimental and control group. From the table it is clear that there is no significant difference on first four criteria of assessment of quality of performance. However on fifth criterion of assessment (time taken) the scores show highly significant difference (where  $t=7.424$ ) between the two groups. The experimental group took significantly less time than control group to perform the activity.

**Table – 4:** Difference in the performance of two groups on self-help skill- (Cleaning the sink)

S. No.	Assessed Aspects	Experimental Group (N=10)		Control Group (N=10)		Statistical Value	
		Mean	SD	Mean	SD	't'	p
1.	Uninterrupted task performance	2.40	0.49	1.40	0.66	3.849	<0.05
2.	Coordinated body action	2.30	0.64	1.60	0.49	2.746	<0.05
3.	Absence of supportive instruction	2.20	0.40	1.00	0.63	5.085	<0.05
4.	Clearing work space	1.80	0.40	1.00	0.63	3.390	<0.05
5.	Time taken in seconds	96.90	13.71	133.80	18.21	5.119	<0.05

As per the table it is clear that the subjects of experimental group show better performance than the control group subjects. Most significant difference has been obtained on the third criterion of assessment (absence of supportive instruction  $t=5.085$ ). The two groups were significantly different on all criteria of assessment as it is evident from the significant 't' values. The experimental group also took less time than the control group for the completion of the task and the obtained 't' value ( $t=5.119$ ) is significant.

**Table –5:** Difference in the performance of two groups on self- help skill (Clearing dinning table)

S. No.	Assessed Aspects	Experimental Group (N=10)		Control Group (N=10)		Statistical Value	
		Mean	SD	Mean	SD	't'	p
1.	Uninterrupted task performance	2.50	0.50	1.50	0.50	4.472	<0.05
2.	Coordinated body action	2.30	0.46	1.20	0.75	3.954	<0.05
3.	Absence of supportive instruction	2.20	0.60	1.30	0.78	2.892	<0.05
4.	Clearing work space	1.70	0.64	1.10	0.74	1.939	>0.05
5.	Time taken in seconds	156.30	17.59	172.40	22.49	1.783	>0.05

The table shows that the subjects of experimental group have performed better than the control group subjects on all four criteria of assessment of quality of performance. Most significant difference between the two groups was seen with regard to the uninterrupted task performance ( $t=4.472$ ), followed by coordinated body action ( $t=3.954$ ) and absence of supportive instruction ( $t=2.892$ ). Also, in time taken for accomplishing the task the experimental group took significantly less time than the control group.

## DISCUSSION

On the basis of the results it may be concluded that use of task analysis technique produces significant improvement in the performance on self-help and civic skills of mentally retarded children. This technique is a better teaching style. This has also been stated by Bigge (1991) when he said that task analysis help teachers identify (a) what steps are necessary to accomplish the task? (b) Where students are having difficulty with a task? (c) What should be taught next? and (d) what adaptations may assist students with task accomplishment?

During the intervention period the experimental group students did the work better than the control group students. It may be due to the fact that when an activity was taught in a stepwise pattern (as they do in task analysis technique) they could learn the activity with great interest. When the researcher taught the activity to control group students by regular pattern, the students did not learn it easily, they missed the steps, and they broke the sequence of work again and again. Students of control group were capable of doing the activity but their quality of performance was poor and they required more repetition and consumed more time than the experimental group. Winterling et al. (1992) used this technique to teach safety skills to moderately mentally retarded children of high school and found that students of experimental group were able to achieve mastery in the skill in contrast to the students of control group who took greater time in learning and also were unable to develop mastery in the skill.

Although performance of experimental group was better on tying shoelaces, the difference in the two groups was not significant. This task was also divided in smaller tasks but the steps of tying shoelaces were intricate and complex and mentally retarded children were not able to have a sustained interest and concentration for achieving success in the task. Moreover this is a fine motor skill and it needs more concentration but a mentally retarded child has a short attention span and low frustration tolerance for failure. It was the investigator's observation that after repeated failure these children show aggressiveness, resulting in diversion from activity at hand. It may be concluded that although tying shoelaces was taught by the task analysis technique, it needed more teaching time and practice to ensure their mastery in performance.

The results of the present investigation are enough to support the usefulness of Task Analysis as a valuable technique for teaching mentally retarded children.

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## APPLICATION OF DYE EXTRACTED FROM NEEM (*AZADIRECTA INDICA*) BARK AND LEAVES ON COTTON FABRIC AND EVALUATION OF MICROBIAL PROPERTIES OF NEEM DYE

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For thousands of years the beneficial properties of Neem (*Azadirachta indica* A. Juss) have been recognized in the Indian tradition. Each part of the neem tree has some medicinal property. The importance of the neem tree has been recognized by US National Academy of Sciences, which published a report in 1992 entitled 'Neem - a tree for solving global problems'. In the present study neem (*Azadirachta indica*) was used as a natural dye source to dye cotton fabric. The chemicals used for the research work were Harda, Alum, Tannic acid, Stannous Chloride and Ferrous Sulphate. All cotton fabric dyed with Neem leaves and bark and pre mordanted with 1% and 3% concentration showed good to excellent results for washing and dry rubbing fastness at the selected pH of 7. The shades obtained were ranging from ivory to lime yellow and golden brown. The natural antibacterial property of neem bark and leaves was observed in the dyed samples.

**KEY WORDS:** Neem dye, Neem bark dye, antibacterial properties, natural dye

Dye is any substance, natural or synthetic used to color various materials, especially textiles, leather and food. The dye is usually used from an aqueous solution and may require a mordant to improve the fastness of the dye on the fibers. Natural dyes were of animal, vegetable and mineral origin. The greatest source of dyes has been the plant kingdom, notably roots, berries, bark, leaves and wood, but only a few have been used on a commercial scale. This is because preparation and extraction of natural dyes entails intensive labor, sustained supply of raw materials, and right technologies. These factors made synthetic dyes the most convenient alternative.

Research and Development has not only identified new and more, raw materials but has also advanced in technology for production and application of natural dyes on textiles. In the world of environmental ecology conservation, natural colorants have attracted the attention of the whole world. India has the unique distinction of being one of the few countries in the world bestowed by nature with various types of plant species. The role of the dyestuff industry in introducing contamination to the environment is increasingly being criticized. There is an increasing realization in the textile industry as well as among the textile consumers to develop and demand eco-friendly method of dyeing the textiles. Natural dyes offer an important supplement in this regard, are safe in use with minimum health hazards and cause less disposal problem.

The microorganisms play a vital role in deterioration of any material, which is susceptible to attack. The routinely used textile materials or those, which are coming in contact with the body, are more prone to attack by microorganisms. This is because during perspiration or when in contact with the body the organisms present on the body gets transferred on to fabric or related material. If such textile materials are nonresistant to attack by microorganisms then it can lead to deterioration and hence change in the physical properties. Such materials are not only of poor quality but can also cause some skin irritation or allergies. Hence, it is of utmost importance to incorporate some form of



anti- microbial agent in the textile material to get good quality, longer durability and better aesthetic value. Textiles along with their antibacterial or anti fungal finishes (<http://www.btra.com>) also need to be skin friendly and resistant to washings, for effective usage.

The present study has been designed with the following objectives: -

1. To find out the dyeing properties of neem leaves and bark on the cotton fabric.
2. To study the use of different mordants like Alum, Harda( Myrobolan), Stannous Chloride, Tannic acid and Ferrous Sulphate on the dyeing properties of neem bark and leaves extract.
3. To study the color fastness properties of the dyed fabric.
4. To determine the microbial properties of the dyes obtained from neem leaves and bark.

## PLANT INTRODUCTION

*Azadirachta indica* A. Juss: (MELIACEAE)

**Local name:** Neem tree, Nim, Nimb.

**Description:** The Neem tree - *Azadirachta indica* - is an evergreen of the tropics and sub-tropics. It is native to India, but widely planted and naturalized throughout Asia, Africa and Australia. It belongs to the family Meliaceae. It may reach up to 15m tall under ideal conditions, and is reported to live for up to 200 years. It can tolerate high temperatures and rainfall as little as 45cm.

**Part used:** Leaves, Bark, Flowers, Seeds, Oil

**Chemical Constituents:** The bark contains tannin, non-tannin and red dye. The bark exudes a clear, bright, amber-colored gum, known as the East India gum. The leaves contain nimbin, nimbinene, 6-desacetylnimbinene, nimbandiol and quercetin. The presence of  $\beta$ -sitosterol, and nonacosane is also reported. Analysis of the mature leaves gave moisture, protein, fat, fibers, carbohydrates, minerals, calcium, and phosphorus, iron, thiamine, and niacin and vitamin carotene. The fruits contain gedunin, 7-deacetoxy-7  $\alpha$ -hydroxy gedunin and nimbiol.

**Uses:** The bark is bitter, astringent, acid, refrigerant, liver tonic, expectorant, urinary astringent and tonic. It is useful in vitiated condition of pitta, leprosy, skin diseases, eczema, and malarial fever, wounds, and ulcers, burning sensation, cough, diabetes, vomiting and fatigue.

The leaves are bitter, astringent, appetizer, antiseptic and refrigerant. They are useful in vitiated conditions of pitta, burning sensation, leprosy, skin diseases, leucoderma, ulcers, eczema and malarial and intermittent fevers. (Biswas et al, 2004)

## METHODOLOGY

The experiment was conducted using the following steps

1. Identification of the locale of the study
2. Samples and their selection: (a) Fabric (b) Dye material
3. Steps of the experiment
  - Preparation of the cotton fabric for dyeing.
  - Extraction of the dye from neem leaves and bark.
  - Mordanting and dyeing of the sample.
  - Assessment of the color fastness and microbial properties.

**SELECTION OF MATERIAL** - 100% pure broad cotton cloth was used for the study i.e. 2 meters of pure cotton from the same belt (roll). Plain weave cotton fabric was selected for the experiment.

**NATURAL DYE** - Dry neem leaves and dry bark were chosen. Bark and leaves were collected from the neem tree growing in the university campus. Neem leaves and bark were dried in air under the shade and stems were removed.

**PREPARATION OF COTTON FABRIC BEFORE DYEING** - To remove different types of natural as well as added impurities from the fabric different purification methods were used-

- I) Scouring
- II) Bleaching

**EXTRACTION OF DYE** - Required amount of dye (25gm dye powder dissolved in 500ml distilled water) was soaked overnight in water, maintaining the material liquor ratio to 1:20. The heat treatment was carried out at 90°C for 30 minutes for leaves and 45 minutes for bark, maintaining the level of solution in the container throughout. After the heat treatment, the dye solution was allowed to cool in the dye bath and later filtered through a muslin cloth.

#### MORDANTING

Mordants used were Harda (Myrobolan - Terminalia chebula) Alum (Aluminum Potassium Sulphate) Iron (Ferrous Sulphate) Tin (Stannous chloride) and Tannic acid. Two different concentrations of mordants i.e. 1% and 3% were applied under optimum conditions. Percentage of the mordants on the weight of the sample was dissolved in water maintaining the material liquor ratio as 1: 40 and 1: 30 in the bath. Usually for dyeing material: liquor ratios of 1: 20, 1:30 and 1:40 are used depending upon the size of the lot. 1:20 material liquor ratio is not suitable for open dyeing as the liquor to the weight of sample is too less and it evaporates leaving the fabric exposed to air. Samples were introduced individually into separate mordant baths. The solutions were slowly heated and the temperature was maintained at 60°C for 30 minutes. Mordanted samples, other than Harda, were allowed to stand for 10 minutes. They were then gently washed and dried in shade. In case of Harda the mordant bath was prepared by dissolving the Harda powder (1gm and 3 gms) in 100ml cold water and allowing it to stand for 1 hour. The sample was dipped in the required amount at room temperature (34±2°C). After 1 hour, sample was squeezed and dried.

#### DYEING

In pre-mordanting method, the cotton fabric samples were treated with a mordant prior to dyeing. The samples were dyed with 100% concentration of the dye solution on the weight of the samples, maintaining the temperature at 80° - 90° C for 45 minutes. The pH of dye bath was maintained in three levels acidic (pH 4-5), neutral (pH 7) and alkaline (pH 9-10). Acidic pH of 4-5 was tested and no color was obtained. pH 7 and pH 9-10 were therefore used for the study. The present paper however represents the results obtained with pH 7 alone. After the dyeing, the samples were allowed to cool in the dye bath for 10 - 15 minutes. Later they were washed and dried in shade. Unmordanted sample was also dyed. This sample was considered as the control sample for comparison of results with mordanted and dyed samples.



**COLOR FASTNESS TEST:**

The samples were subjected for color fastness tests using the following ISO standards:-

- 1) Color fastness to washing: - ISO - 105 - col : 1989 (E)
- 2) Color fastness to rubbing: - ISO - 105 - x 12 : 1993 (E)
- 3) Color fastness to perspiration: ISO - 105E 04 : 1994 (E)
- 4) Color fastness to light: -- AATCC - Test method 16 - 1998

**COLOR FASTNESS RATING:**

- 1) Grey Scales were used for evaluating change in color:  
 ISO 105 - AO2 1993  
 BSEN 2010 S - AO2 1995  
 BS - 1006 - AO2 1990  
 SDC - Standard methods 5<sup>th</sup> Edition AO2
- 2) Grey Scale for assessing staining:  
 ISO 105 - AO3 1993  
 BSEN - 20105 - AO3 - 1995  
 BS - 1006 - AO3 - 1990  
 Standard method 5<sup>th</sup> Edition AO3,

**RATING**

STAINING	COLOR
5 - negligible staining	5 - Excellent
4 - slight staining	4 - good
3 - noticeable staining	3 - fair
2 - considerable staining	2 - poor
1 - much changed	1 - very poor.

**ASSESSMENT OF MICROBIAL PROPERTIES****Reagents: -**

Standard plate count agar, potato dextrose agar, lactose broth, trypticase Soya broth/soybean casein digest medium, eosin methylene blue agar, MacConkey agar, bismuth sulphite agar, hektoen enteric agar, xylose lysine deoxycholate agar, Vogel Johnson agar base, tetrathionate broth base, selenite cystine broth base and antibiotic (oxytetracycline).

**Test Method: -**

**Aerobic plate count:** Specimen was enriched in sterile phosphate buffered dilution water & subsequently plated on standard plate count agar. Specimen was incubated for 48 hours at temperature 35°C. Colonies on plate were counted.

**Yeast & Molds:** Specimen was enriched in sterile phosphate buffered dilution water & subsequently plated on potato dextrose agar. 1 ml of oxytetracycline antibiotic solution was added to each plate. Specimen was incubated for 96 hours at temperature 25°C. Colonies on plate were counted.

**Coliforms:** Specimen was enriched in tube of Lauryl sulphate tryptose {LST} broth. Specimen was incubated for 48 hours at temperature 35°C. Colonies on gassing tubes were counted.

**Escherichia coli:** Specimen was enriched in lactose broth & subsequently plated on MacConkey agar. Specimen was incubated for 24 hours at temperature 35°C. After 24 hours plated on MacConkeys agar and incubated for 24 hours at temperature 35°C.

**Salmonella:** Enrichment was performed and lactose broth to tetrathionate broth & subsequently plated on Xylose lysine desoxycholate (XLD) agar. Enrichment was incubated for 48 hours at temperature 35°C. After 24 hours plated on Xylose lysine desoxycholate agar (XLD) and incubated for 24 hours at temperature 35°C.

**Staphylococcus aureus:** Specimen was enriched in trypticase Soya broth & subsequently plated on blood agar & Vogel Johnson agar. Specimen was incubated for 48 hours at temperature 35°C. After 48 hours plated on blood agar & Vogel Johnson's agar and put for further incubation for 48 hours at temperature 35°C.

## RESULTS AND DISCUSSION

Table 1: Color shades obtained on dyeing

S. No.	Mordants	Cotton Dyed Shades of <i>Azadirachta indica</i> (Neem)	
		Pre-Mordanting	
		Neem leaves	Neem bark
		Aqueous (pH7)	Aqueous (pH7)
1.	Harda	Jasmine Cream	Light Brown
2.	Alum	Light Mid Cream	Deep Cream Brown
3.	Tannic Acid	Light Mimosa Cream	Light Lime Brown
4.	Stannous Chloride	Lime yellow	Light coffee Brown
5.	Ferrous Sulphate	Deep Golden Brown	Leaf Brown

Table 1 presents the different color shades obtained on dyeing cotton with neem leaves & neem bark using different mordants.



**TABLE 2: Fastness properties of Cotton fabric dyed with *Azadirachta indica* (Neem leaves) extract (pH 7)**

Mordant-ing method	Mordant	Conc of mordant	Washing Fastness		Rubbing Fastness				Perspiration Fastness				Light Fastness
					DRY		WET		Acidic		Alkaline		
Pre mordant -ing			CC	CS	CC	CS	CC	CS	CC	CS	CC	CS	
	Hurda	1%	4.5	5	4	4.5	4.5	3.5	4.5	4.5	4.5	4.5	3.5
		3%	5	5	5	4	4	4.5	5	3.5	4.5	4.5	3.5
	Alum	1%	4.5	4	4.5	4	4	3.5	4.5	4	3.5	4.5	CI
		3%	4	4.5	4	4	4	3	4	4	4	4	4
	Tannic Acid	1%	4	4	5	4	4	4.5	4.5	3.5	4	4.5	4
		3%	4	4.5	4.5	4	3.5	3.5	4.5	4	4	4	3.5
	Stannous Chloride	1%	5	5	4.5	5	4	4.5	4	4.5	4.5	5	4
		3%	5	4.5	4.5	4.5	4	4.5	4.5	4.5	4.5	4.5	3.5
	Ferrous Chloride	1%	5	4.5	4.5	4	4	4	5	4.5	4	4.5	CI
3%		4.5	5	4	4	4	4	4.5	4	4	4	4	

**Note:**

CC – Color Change

CS - Color Staining

CI - Color Increase

IH – Increase Hue

Table No. 2, indicates the results of color fastness test of *Azadirachta indica* leaves dyed cotton samples using Harda, Alum, Tannic acid, Stannous Chloride & Ferrous Sulphate mordants in aqueous medium (pH - 7).

It is found that the samples mordanted with Stannous Chloride, Ferrous Sulphate & Harda showed excellent washing fastness and samples mordanted with Alum and Tannic acid showed colorfastness between good to excellent.

It was observed that the dyed samples with all mordants had no change and slight staining of the adjacent fabric when subjected to dry rubbing, where as in case of wet rubbing there was no change in color of dyed cotton samples but 3% Alum, 1% Harda, 3% Stannous-chloride mordanted samples showed noticeable staining and Ferrous Sulphate showed slight staining.

**TABLE 3: Fastness properties of Cotton fabric dyed with *Azadirachta indica* (Neem Bark) extract (pH 7)**

Mordanting method	Mordant	Conc. of mordant	Washing Fastness		Rubbing Fastness				Perspiration Fastness				Light Fastness
					DRY		WET		Acidic		Alkaline		
Pre mordanting			CC	CS	CC	CS	CC	CS	CC	CS	CC	CS	
	Harda	1%	4.5	4.5	4.5	4	4	4	4.5	4.5	4.5	4.5	4
		3%	4.5	4.5	5	4.5	4.5	4	4.5	4	4.5	4	4
	Alum	1%	5	4.5	5	4.5	4	4	4	4	4	4	4
		3%	5	4.5	5	4.5	4	3.5	4.5	4.5	4.5	4.5	Change in tone
	Tannic Acid	1%	4.5	4.5	4.5	4.5	4.5	4	4	4.5	4.5	4.5	4
		3%	4.5	4.5	4.5	4	4.5	4	4	4	4.5	4.5	4
	Stannous Chloride	1%	5	5	4.5	4.5	4.5	3.5	4.5	4	4	4	3.5
		3%	4.5	4.5	4.5	4.5	4.5	3	4	4	4.5	4	3.5
	Ferrous Chloride	1%	4.5	5	5	4	4.5	4	4.5	4.5	4	4.5	4
3%		4.5	4.5	4.5	4	4.5	3.5	4.5	4	4	4.5	4	

**Note:**

CC – Color Change,

CS - Color Staining

Table No. 3 indicates the results of color fastness test of *Azadirachta indica* bark dyed cotton samples using Harda, Alum, Tannic acid, Stannous Chloride & Ferrous Sulphate mordants in aqueous medium (pH7).

All cotton samples showed good to excellent fastness to washing. After washing no staining was visible on adjacent fabric.

Acidic and alkaline perspiration fastness for cotton samples showed good results and there was slight to noticeable staining on adjacent fabric.

All dyed samples showed good to excellent ratings for dry rubbing test, and fair to good for wet rubbing tests. But in case of wet rubbing 3% Alum, 1% Stannous chloride and 3% Ferrous sulphate treated samples showed noticeable to slight staining on adjacent fabric.

All dyed samples showed good light fastness, except 3% cotton sample treated with Alum, which showed change in tone during exposure to sunlight.



**TABLE 4: Microbial properties of fabric dyed with *Azadirachta indica* (Neem) leaves and bark**

Parameters	Un dyed cotton fabric	Dyed cotton fabric with neem leaves	Dyed cotton fabric with neem bark
APC per gm	1550	40	110
Yeast & Molds per gm	30	Nil	10
Coliform MPN per gm	Nil	Nil	Nil
E. Coli per gm	Negative	Negative	Negative
Salmonella per gm	Negative	Negative	Negative
Staphylococcus aureus per gm	Negative	Negative	Negative

**Note:** APC - Aerobic plate count

The results for Coliform, E.coli, Salmonella and Staphylococcus aureus were all negative. It was observed that undyed cotton fabric had APC per gm of 1550. The dyed sample of cotton fabric with neem bark and neem leaves were also exposed to same laboratory condition and it was observed that APC in case of dyed cotton fabric with neem bark was 110, dyed cotton fabric with neem leaves was 40. Similarly Yeast & Molds per gm in dyed cotton fabric with neem leaves was found to be nil compare to the values of 30 for the un-dyed fabric. The dyed cotton fabric with neem bark had value of 10 per gm. Therefore it can be concluded that the cotton fabric dyed with neem leaves had no Yeast & Molds growth and Aerobic plate count was also very low. Therefore neem dyed fabrics are most suitable for persons with allergic skin condition and sensitive skin.

## CONCLUSION

Natural dyes are again getting importance due to harmful effects caused by synthetic dyes during their production and use. Vegetable dyeing industry can promote indirect employment in cultivation of plants and herbals matter in waste lands which are widely spread all over India. The art of dyeing with vegetables dyes has gained momentum not only for the safety of health and environment, but also for their beauty and novelty. Hence consideration of natural dyes is not an innovation, it is revival; revival with revised technology and scientific methodology.

In the present study neem (*Azadirachta indica*) was used as a natural dye source to dye cotton fabric. The chemicals used for the research work were Harda, Alum, Tannic acid, stannous chloride and Ferrous Sulphate. All other chemicals used were of laboratory reagent grade.

Cotton fabric was selected for the present study. Before dyeing cotton fabric was scoured and bleached to remove all impurities. After bleaching the samples were pre mordanted with mordant solution at 60°C for 30 minutes. The samples were taken out, squeezed and cooled at room temperature and then transferred to the dye bath.

From the result of the present study, it may be concluded that –

1. All cotton fabric dyed with Neem leaves and bark and pre mordanted with 1% and 3% concentration showed good to excellent results for washing and dry rubbing fastness at the selected pH of 7
2. The wet rubbing fastness of dyed samples varied from fair to good.

3. All the samples showed good to excellent color fastness to both alkaline and acidic perspiration.
4. All the samples showed fair to good color fastness to sunlight. But samples pre mordanted with alum and stannous chloride showed change in tone.
5. The natural antibacterial property of neem bark and leaves was observed in the dyed samples. Therefore it may be said that the fabric dyed with neem dye will be beneficial for persons suffering from skin allergies.

## ACKNOWLEDGEMENT

The Authors are thankful to UGC for providing the financial grant for the ongoing major research project 'Evaluation and Documentation of Natural Dye sources of Western Rajasthan'. The present research paper is based on the findings of one of the plant sources.

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