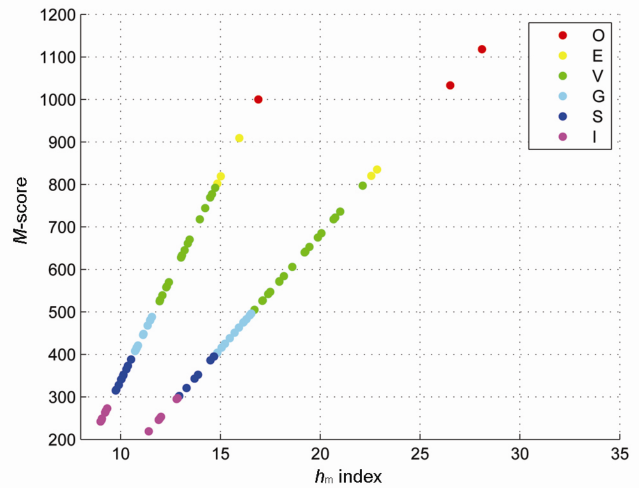

Figure 3. Scatter plot based on the h_m-index and *M*-score values from Tables 2 (specialization 'A') and 3 (specialization 'B') together. Each colour indicates a specific grade assigned to the scientists based on their new *M*-score value calculated in the context of their specialization.

values. Each colour value indicates a particular grade (OEVGSI) assigned to the scientists based on their respective *M*-score values. Effectively, this scatter plot splits the vertical axis (grades) into six zones, making the distribution of the *M*-score values easier to understand. Figure 3 shows the scatter plot based on the h_m-index and *M*-score values from Tables 2 (specialization 'A') and 3 (specialization 'B') together. As in Figure 2, here also each colour value indicates a specific grade assigned to the scientists based on their *M*-score value calculated in the context of specialization. The shift in the *M*-score values and the corresponding grades, when calculated in the context of specialization, is evident from Figures 2 and 3.

In conclusion a new context-specific scientometric named M-score has been proposed in this paper. The scientific productivity of an individual relative to others in the field (specific context/group) can be easily assessed using the *M*-score. The significance of the proposed *M*-score and how its value changes according to a specific context have been well established with the help of a sample dataset from Google Scholar.

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Measurement of environmental external gamma radiation dose rate outside the dwellings of southern coastal Odisha, eastern India

N. Sulekha Rao[1], Kajori Parial[1], Hiroaki Koide[2] and D. Sengupta[1,*]

[1]Department of Geology and Geophysics, Indian Institute of Technology, Kharagpur 721 302, India
[2]Research Reactor Institute, Kyoto University, Kumatori-cho, Sennan-gun, Osaka 590-04, Japan

External gamma dose rate measurement using thermoluminescent dosimeter has been performed along the southern coast of Odisha, eastern India. A total of nine villages from the three sectors, viz. Gopalpur, Chhatrapur and Rushikulya have been selected for the study. The average external gamma dose to people residing in the three sectors is 3.77, 4.47 and 3.57 mSv year^{-1} respectively, which is ~3–4 times the international limit of 1 mSv year^{-1}. These values are high compared to other high background radiation areas like Tamil Nadu along the east coast of India, but are comparable to the high radiation areas in Kerala, along the west coast of India.

Keywords: Coastal dwellings, eastern Indian beach placer, external gamma dose, natural radioactive hazard, thermoluminescent dosimeter.

RADIATION is present everywhere on the Earth's surface since its origin. According to UNSCEAR[1], about 87% of the radiation dose received by mankind is from natural sources and the remaining is due to anthropogenic sources. The dose received by the population in a region comprises of (i) external gamma radiation dose due to cosmic rays and primordial radionuclides; (ii) inhalation dose due to radon, thoron and their progeny, and (iii) ingestion dose due to the intake of radionuclides through the consumption of food, milk, etc. Environmental gamma-ray background generally refers to the gamma radiation from radioactivity in the environment, i.e. from terrestrial sources and building materials. The assessment of external exposure due to terrestrial radiation is possible, and in a given place its distribution is found to be dependent on the geographical characteristics of that place. There are several international studies reported for measurement of terrestrial gamma radiation background levels using the technique of thermoluminescence to assess the dose to the population[2–14]. In India, the west coast is a high-background radiation area (HBRA) due to monazite content in the sand. Preliminary studies on external gamma radiation dose level measurement with thermoluminescence

*For correspondence. (e-mail: dsgg@gg.iitkgp.ernet.in)

dosimeters (TLDs) have been reported in the literature[4,15]. In the east coast, TLD study was undertaken in Tamil Nadu[16] and Chhatrapur region in coastal Odisha[4,17]. As Chhatrapur beach placer deposit is known as a HBRA, a detailed TLD study in the adjoining areas of Gopalpur–Chhatrapur–Rushikulya sectors was carried out in the present study.

The study area is along the southern part of coastal Odisha (Figure 1) in Ganjam district. The study area is divided into three sectors, i.e. Gopalpur, Chhatrapur and Rushikulya from south to north. Three villages from each sector, namely Garampeta, Dhabaleswari and Gopalpur from Gopalpur sector; Mattikhalo, Aryapalli and Nuapalli from Chhatrapur sector, and Parumpeta, Batteswar and Proyagi from Rushikulya sector were chosen for the TLD study (Figure 1).

TLDs were installed outside the selected dwellings (2–4) in each village for a period of three months during January–March 2007. $CaSO_4$–Tm powder was used as the dosimetric material. The TLD powder was prepared by well-standardized cleaning and pre-heating methodology of sieving, cleaning with distilled water and heating at 420°C for 2 min in an electric furnace to erase the previous dose history. The processed powder was filled in glass capsules of 2 mm diameter and 12 mm length and again placed in a plastic capsule for complete protection (Figure 2). The prepared TLDs were deployed outside the selected dwellings in the villages for the tenure of three months during January–March 2007. The retrieved TLDs were analysed using a computerized Panasonic UD-5120PGL TLD Reader (Matsusita Electric Co, Japan) at 380°C for 10 sec (after switching on, the instrument needs 30 min to stabilize). The external gamma dose was calibrated to the effective dose (mSv). So, no conversion coefficient was used for conversion from absorbed dose in air to effective dose (Figure 2).

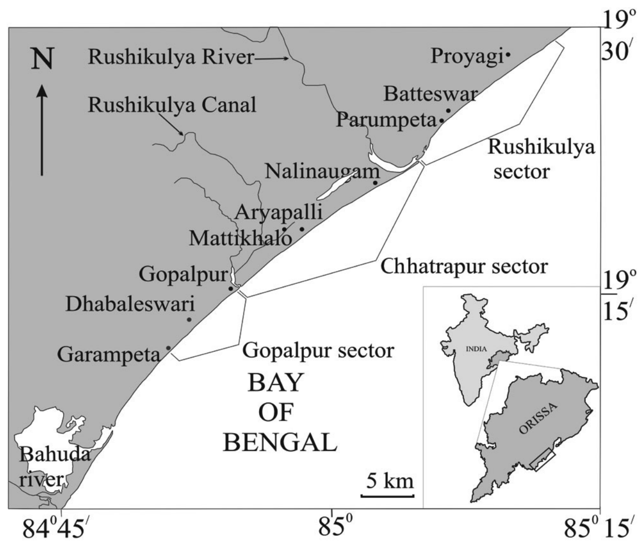

Figure 1. Map showing the geographic location of villages in the Gopalpur–Chhatrapur–Rushikulya sectors along southern coastal Orissa.

The average external gamma dose rates of each sector are presented in Table 1. The outdoor external gamma radiation dose of Gopalpur–Chhatrapur–Rushikulya sectors is in the range 2.2–7.7 mSv $year^{-1}$. Highest value is recorded at Aryapalli village in Chhatrapur sector, which is just beside the Indian Rare Earth Limited (IREL) and the lowest value is recorded at Dhabaleswari in Gopalpur sector. The average external gamma dose (mSv $year^{-1}$) of Gopalpur, Chhatrapur and Rushikulya sectors is 3.77, 4.47 and 3.57 mSv $year^{-1}$ respectively (Table 1).

Figure 3 presents a comparison of the average annual terrestrial gamma radiation dose rate in Gopalpur, Chhatrapur and Rushikulya sectors, from the present study with those reported[14] in other places of the world. The terrestrial external gamma radiation dose rates reported in this study are higher by one order of magnitude when compared to other coastal areas in the world (Figure 3).

The dose rate in the three sectors of the present study area is much higher than the world average value of

Table 1. External gamma dose rate (mSv $year^{-1}$) in nine villages along Gopalpur–Chhatrapur–Rushikulya beach placer deposit

Sector	Village	Dose rate (mSv $year^{-1}$)	Avg. dose rate (mSv $year^{-1}$)
Gopalpur	Garampeta	3.8	3.77
	Dhableswari	2.2	
	Gopalpur	5.3	
Chhatrapur	Mattikhalo	3.2	4.47
	Aryapalli	7.7	
	Nuapalli	2.5	
Rushikulya	Parumpeta	3.9	3.57
	Batteswar	3.8	
	Proyagi	3.0	

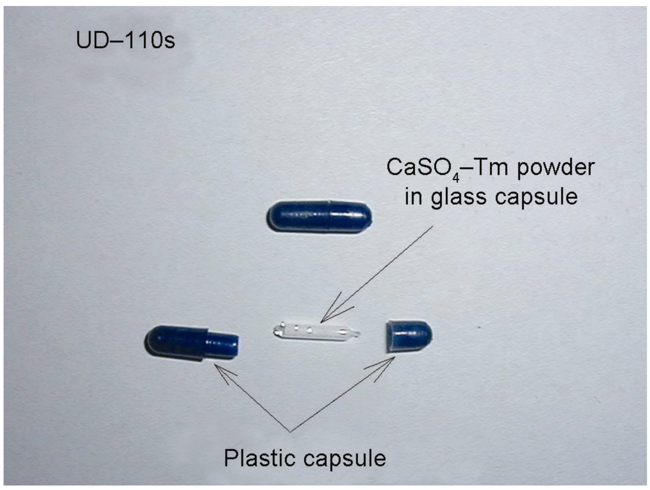

Figure 2. Thermoluminescent dosimeter.

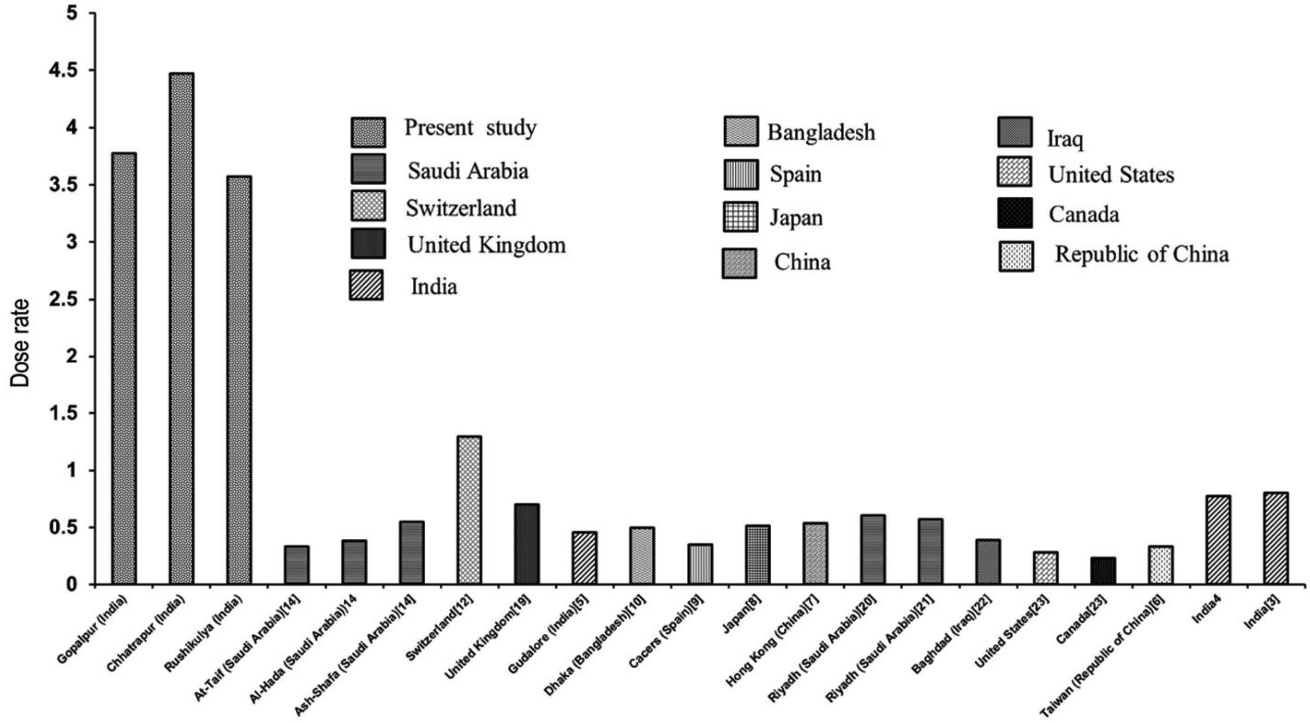

Figure 3. Comparison of terrestrial gamma radiation dose rate in Gopalpur, Chhatrapur and Rushikulya sectors with those from the other places in the world.

1 mSv year^{-1} (refs 16, 18). In India, the indoor annual effective dose to people residing along the east coast region of Tamil Nadu is 1.3 mSv year^{-1} (ref. 16) and the annual effective dose (indoor) in Kerala is 0–5 mSv year^{-1} (ref. 15). Nambi *et al.*[4] estimated the average external gamma radiation dose rate as 0.77 mSv year^{-1} based on TLD measurements. Therefore, based on this study, it is inferred that the external gamma dose in the present study area is higher than the average worldwide dose; however, it is less than that reported for other HBRAs.

The present study undertaken along coastal villages of Odisha, indicates higher external gamma dose compared to the average global dose. The source of this high dose is mainly the thorium-rich monazites. This could be attributed to the presence of minerals enriched in thorium, controlled by geological processes like shoreline alteration due to coastal processes, marine transgression and regression, fluvial activity due to the presence of rivers coupled with continued erosion by air and water, which increases with time. The extraction of economic resources like ilmenite, rutile, garnet, sillimanite and zircon both for local supply and export from the beach sands, contributes effectively as this has progressed for more than 30 years. This is effectively much more than the extraction of thorium-rich monazites due to their limited applications both in India and abroad. The continuous mining of the beach placers enhances the dose exhibited in this region, as observed in the present study. This entails a proper mining strategy and suitable remediation methodology to be adopted on an urgent basis. The utilization of the subsequent waste should be monitored and not used for dwelling and construction purposes, to avoid high exposure to the local population. In addition, the local groundwater aquifers should be isolated to avoid any contamination due to the leaching of radionuclides present. The latter is of utmost importance due to the ingression of saline sea water which is occurring now in these coastal regions, due to enhanced extraction of groundwater and subsequent contamination.

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In vitro embryo production in buffalo: effects of culture system on pre-implantation development and gene expression pattern

Sadeesh E. M.*

Division of Animal Physiology and Reproduction,
ICAR-Central Institute for Research on Buffaloes, Hisar 125 001, India

Expression profile of developmentally important genes can be used to optimize the *in vitro* culture system to produce superior quality buffalo embryos. In nearly all the studies on *in vitro* embryo production of buffaloes, the presumptive zygotes are subjected to an *in vitro* culture system which involves use of TCM-199 or simple media like charles rosenkrans and synthetic oviductal fluid with or without serum; however, these media do not fully mimic the *in vivo* conditions. The inhibitory or stimulatory effects of culture conditions on the expression of candidate genes involved in buffalo embryo development, quality and stress response will help identify the post-fertilization culture environment effects on *in vitro* developmental characteristics of embryo. Further, identification of genes whose expression profiles are frequently abnormal in *in vitro* fertilized (IVF) embryo derived from different culture systems will help provide markers for the diagnosis of IVF embryo viability prior to embryo transfer, and thus negate the time and money-consuming transfer of non-viable embryos to recipient animals. The studies reported here explore the possibility of establishing a suitable culture system which provides greater *in vitro*-development of embryos in buffalo.

Keywords: Buffalo, culture media, embryo, gene expression, *in vitro* production.

SUBSTANTIAL progress has been achieved in assisted reproductive technology (ART) in animals during the last decade. However, the overall efficiency of some of these techniques is less than expected. For example, *in vitro* culture of oocytes and embryos, composition of the media and environmental conditions can have a profound effect on the final outcome in *in vitro* fertilization. In spite of progress made in procedures for *in vitro* maturation, fertilization and culture of bovine oocytes, the percentage of embryos which are able to develop normally *in vitro* is less than that under *in vivo* conditions[1–3]. Several differences have been shown between these two types of embryos such as cell number, lipid content, tolerance to cryopreservation and chromosomal abnormalities[4–6]. Despite a similar maturation rate (87% versus 94%), a significantly lower cleavage rate (65% versus 84%) has been observed in buffaloes than in cattle[7,8]. It is, therefore, a

e-mail: sadeeshcirb@gmail.com