A Compilation on Valuations of T-Toxin, Fumonisin and Zearalenon Quantities in Wheat Grain Crops Harvested from North, West and South Suprime Provinces of Iran

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ABSTRACT

Wheat is one of the most important grains consumed in the world. Food contamination with toxigenic moulds increased attention over the last three decades, which impact on food safety. Fumonisins, the TCs and ZEA are hazardous for human and animal health as they are stable to heating and are not degraded during normal food processing, therefore, a rapid and sensitive technique for routine assay of mycotoxins in foods is necessary. It is important to continue to monitor the occurrence of these mycotoxins in cereals and cereal products. Since Fusarium species are commonly associated with cereals can produce several secondary toxic metabolites the samples collected from provincial premier and preparation of cell extracts then toxin estimation were done by ELISA (Kits and Rida Screen T-toxin, Fumonisin and zearalenon analysis R-Bio-Pharm GmbH ) on the samples so that T-toxin, Fumonisin and zearalenon to be analyzed. The determinative pollutions of wheat samples were in the Range; 19.100 (Min; 27.200, Max; 46.300) ppb for T-toxin, Range; 6.780 (Min; 16.560, Max; 23.340) ppb for Fumonisin and Range; 8.700 (Min; 11.140, Max; 19.840) ppb for Zearalenon. Statistic definitions for WT – Wzea (Z; -3.296a, Asymp-Sig.; 0.001), WT – Wfum (Z; -3.296a, Asymp-Sig.; 0.001) and were showed a considerable disalignmented correlation specially for WFum – Wzea (Z; -3.296a, Asymp-Sig.; 0.001) at a Pearson Correlation; 0.999**, Sig; 0.000 values. Thus according to the standard values for feed and food could be serious attention to the cumulative effects of toxins, a serious risk and that should not be overlooked about the cities and provinces where conducted. The maximum values of found respectively were more than standards 50% up to 100%, so a serious riskare considered.

INTRODUCTION

Mycotoxins are natural food and feed contaminants, mainly of grain is a serious problem in conventional and organic cereal production, considering these substances constitute a potential risk for human and animal, are not only dangerous for the Public Health, but they also deteriorate the marketable quality of food and feed, causing tremendous economic losses (Solarska et al., 2009, Rashedi et al., 2012). Food contamination with toxigenic moulds increased attention over the last three decades, which impact on food safety. Fusarium species, colonise before the harvest (Cvetnic et al., 2004). The most important Fusarium mycotoxins are Fumonisins, TCs such as T-2, HT-2, DON, DAS, FUS-X, NIV, diacetylvalenol, neosolaniol and ZEA. They are common mycotoxins throughout the world, associated with cereal crops, in particular corn, wheat, barley, rye, rice and oats (Ghazvinian et al., 2011, Shephardet al., 2000). Ingestion of food contaminated with mycotoxins can cause mycotoxicosis which is an acute or chronic toxicity which are known to contaminate. (Mankeviciene et al., 2011). Infection of cereal grains with Fusarium species can trigger serious human and animal diseases (Jereon et al., 2013, Mankeviciene et al., 2011), commonly occurs in cereal crops and its derivatives can be produced by Fusarium spp., However, low amounts are synthesized during crop growth whereas the highest amounts are produced by Fusarium during storage (Hazmi., 2010) In addition to corn or corn-based foods and feeds (Trigo et al.,1996, Sadeghi et al., 2012, Rashedi et al., 2012), Fusarium species are probably the most prevalent toxin-producing fungi of the northern temperate regions and are commonly found on cereals grown in the temperate
regions of America, Europe and Asia might occur more frequently in the warmer and subtropical part of the world (Alizadeh et al., 2012, Feizy et al., 2014). (Trigo et al., 1996). Fumonisins, the TCs and ZEA are hazardous for human and animal health as they are stable to heating and are not degraded during normal food processing and consequently, commonly found on cereals grown in the temperate regions of Europe, America and Asia. The toxin is probably the most important of the northern temperate regions (Ghazvinian et al., 2011). The toxin is commonly found world-wide on cereals such as wheat, rye, barley, oats and corn. Cereals products are prevalent used in feed and farm animals may thus consume relatively high amounts as Wheat is one of the most important grains consumed in the world. Epidemiological evidence indicates a link between human esophageal cancer and ingestion of Fusarium contaminated corn (WHO 2001). These are in cereals associated with the incidence of a high rate of human esophageal cancer in Africa, in northern Italy, in Iran, the Southeastern of the United States and with promotion of primary liver cancer in certain endemic areas of the People's Republic of China (Feizyet et al., 2014, Pleadin et al., 2012). There are no confirmed biomarkers for human exposure (WHO 2001), whereas higher concentrations interfere with the health status. Major objectives on mycotoxin produced by genus Fusarium in cereals contribute to determine the distribution and level of Tcs, Fum, Don and Zea in milled fractions and wheat milling performance study (TRIGO-STOCKLI et al., 1996) although the allegation that TCs were responsible for the reported symptoms is controversial (Ghazvinian et al., 2011). Following By now, causing most concern are T-2, which is the most acute toxic TC, HT-2, and NIV (Feizy et al., 2014). TCs are especially well-known inhibitors of protein synthesis, including DNA, RNA synthesis, inhibition of mitochondrial function, effects on cell division and membrane effects. Cellular effects on DNA and membrane integrity have been considered as secondary effects of the inhibited protein synthesis (Feizy et al., 2014). Cytotoxic effects were observed at slightly higher doses of TCs (Ghazvinian et al., 2011). Generally, occurs together cereals products isolated from grains and beans were found to and its derivatives are generally found in various cereal crops such as wheat, corn, barley, oats and rye and processed grains (malt, beer and bread) (Jeroen et al., 2013). Since T-2 tetraol is the most stability metabolite, it is the most appropriate metabolite for diagnostic testing (Marasas et al., 1996). T-2-contaminated products can cause severe effects in humans/animals at the same time it may even result in death. The immune system is the mainly target of T-2, and the effects include changes in leukocyte counts, delayed hypersensitivity, depletion of selective blood cell progenitors, depressed antibody formation, allograft rejection, and a blastogenic response to lectins (Trigo et al., 1996) and cytotoxic effect. The ATA Committee noted that IARC (1993) concluded that no data were available on the carcinogenicity to humans (Feinberg et al., 1989, KARAMI et al., 2008, Solarska et al., 2009). DON is called as vomitoxin because of its strong emetic effects and its action as a feed refusal factor and in developed countries where grains are dried to ≤13% moisture content to prevent mold growth, DON is the most important pre-harvest problem. However, it can also be produced during storage in the world where moisture content of stored grains is less rigorously controlled. Concurrent fungal infections with DON production in the field are mainly dependent on weather conditions and are favored by low temperatures and high humidity. Since DON can be found in many post-harvest products, it is mostly believed to be resistant to standard processes like milling, baking and heating (Mallmann et al., 2001). DON is a mycotoxin that commonly contaminates cereal-based foods worldwide. It is detected often at the ppm level (Mallmann et al., 2001, Remza et al., 2014). DON is generally found in various cereal crops such as wheat, barley, oats, rye, rice and corn. Natural occurrence of DON in cereals is certainly prevalent and surveys from South America, Canada, China and many countries of Europe have showed contamination levels in excess of 50% in oats, barley and wheat with mean concentrations as high as 9 mg/kg in barley (Feizy et al., 2014). DON and either of two mono-acetylated derivatives – 3-and 15-acetyl DON – are frequently found together in cereal-based products (Feizy et al., 2014, Ghiasian et al., 2006). DON is the most often occurring TC and is prevalent in crops used for feed and food production (Solarska et al., 2009, Riazipour et al., 2012). At the cellular level, the main toxic effects of DON are immunosuppressant or immunostimulation depending upon the dose and duration of exposure. DON is less toxic than other TCs such as T-2, however, highly DON doses (i.e. unlikely to be encountered in food) can cause shock-like death (Feizy et al., 2014). There have been reports that in Asia of illness in humans, associated with the consumption of cereals contaminate with DON and possibly much lower doses of other TCs (Feizy et al., 2014). In 1993, IARC placed DON in Group 3, not classifiable as to its carcinogenicity to humans (Trigo et al., 1996, Tanaka et al., 2007). A provisional maximum tolerable intake (PMTDI) of 1 μg/kg body weight (BW) was set by (Mallmann et al., 2001). NIV occurs more often in years with dry and warm growing seasons. NIV is more frequently reported in Europe, Australia and Asia than in America. Both mean levels and incidence of positive samples of NIV are lower than for DON even in the Nordic countries and Europe (Egmond et al., 2004). NIV is a potent inhibitor of protein, RNA, DNA synthesis in mammalian cells and causes necrosis of the proliferating cells especially toxic to rapidly dividing tissues (Tanaka et al., 2010, Marasas et al., 1996). NIV is a weak inducer of chromosomal aberrations in mammalian cells, seems that NIV has the possible to cause DNA-damage. However, the available information is too limited to evaluate the genotoxic potential of NIV (Khosravi et al., 2013). 6 ppm or more of ingestion NIV for one year exhibit a
characteristic toxic effect, is observed that DAS increased at low temperatures in corn and rice is abundant in various cereal crops such as corn, barley, mixed feed samples and other grains from various regions in the world. Co-existence of DAS and T-2 in animal feeds and human foods present a health threat to humans and animals in some parts of the world (Alizadeh et al., 2012). Toxic effects of DAS in humans and animals seemed similar, Also, the hematopoietic system appeared extremely sensitive, showing severe myelosuppression, as teratogen and esophageal hyperplasia. It is not mentioned very frequently in the research, as the main interest for TCs concerns DON, T-2 and HT-2 (Riazipour et al., 2012). ZEA was discovered as the cause of a reproductive disorder in the temperate regions of America, Europe and Asia. It is most frequently encountered on corn, but also contaminates other cereals and plant products (Anne et al., 1995). ZEA is a non-steroidal, estrogenic mycotoxin, produced by Fusarium spp. are of two general types: 1) the non-estrogenic TCs, including DON, NIV, T-2, and DAS; 2) the mycoestrogens, including ZEA and zearalenol (Rashedi et al., 2012). ZEA and some of its metabolites have been shown to competitively bind to estrogen receptors. The most important characteristic of Fusarium species is their ability to synthesize ZEA, and its co-occurrence with certain TCs raises important point regarding additive and/or synergism in the etiology of mycotoxicoses in animals (Schollenberger et al., 2006). TCs are stable compound both during storage/milling and the processing/cooking of food. It does not degrade at high temperatures. ZEA is found, especially, as a contaminant in corn. Also, it may occur in oats, barley, wheat and sorghum associated with reproductive problems in specific animals and possibly in humans (Trigo et al., 1996). ZEA at amounts greater than normally encountered in field exposures (200 mg/kg of feed) does not affect adversely the reproductive potential of specific receptors have been displayed in uterus, mammary gland, liver and hypothalamus in different species (Sadeghi et al., 2012). In any event, the contamination of corn with ZEA is a threat to animal and public health and seriously reduces the quality of corn products. Fertility problems have been observed in animals (Khosravi et al., 2013). Any compound with hormonal activity may be genotoxic and/or carcinogenic ZEA may be an important etiologic agent of intoxication in young children or fetuses exposed, which results in premature thelarche, pubarche, and breast enlargement (Feizy et al., 2014). ZEA was evaluated by the International Agency or Research on Cancer in 1993, based on inadequate data in humans and limited evidence in experimental animals, allocated, together with other Fusarium toxins, in group 3 (not classifiable as to their carcinogenicity to humans). Because of its hormonal activity there is considerable knowledge about ZEA and its derivatives to be found in the patent literature on growth hormones as there is in the literature on mycotoxins. Therefore, a rapid and sensitive technique for routine assay of mycotoxins in foods is necessary. There are several types of chromatographic methods available for mycotoxins analysis. Methods for the detection of mycotoxins are mainly based on chromatography and immunochemistry. Traditionally the most popular methods used for mycotoxins analysis are thin layer chromatography (TLC), high performance liquid chromatography (HPLC), gas chromatography (GC) and capillary electrophoresis (CE). These methods require extensive sample preparation and are expensive. Immuno affinity column use for mycotoxins has increased because of its simple cleanup procedure and lower detection level of mycotoxins. Additionally, simple extraction procedures including Quick, Easy, Cheap, Effective, Rugged, and Safe or modified methods coupled to LC/MS or LC/MS/MS have been increasingly used as alternatives to traditional derivatization and extensive cleanup (Jeroen et al., 2013). Over the last years, the importance and application of immunoassays, especially enzyme-linked immunosorbent assay (ELISA), has grown significantly. ELISA test kits became very popular recently due to their relatively low cost and easy application and their results could be comparable with those obtained by other conventional methods such as TLC and HPLC (Feizy et al., 2014). Several studies carried out in European / transcontinental countries, reported the high incidence of Fusarium toxins in cereals and in animal feeding stuffs. Mycotoxin contamination in cereals is a potential risk to human and animal health. Among several hundreds of mycotoxins, T, Fum and Zea toxins are among the most important mycotoxins regarding food safety (Anne et al., 1996). Furthermore, an association between high rates of human esophageal cancer and high concentration in cereals has been reported in different countries (Trigo et al., 1996). Wheat and rice are as the most important staple food for the human population Worldwide, in particular in the Middle East. These grains are of the highest worldwide production as well as corn (Pleadin et al., 2012). Although contamination by the legal limits vary significantly both from country to country and by mycotoxin type and matrix; the determination methods need to provide accurate and reproducible results both within and between laboratories. Current regulations of fusarium toxins in foods and feeds set by countries from Europe, Asia, Africa and America and reported by FAO (2004). The risks of fusarium toxins have been evaluated by The World Health Organization’s International Programme on Chemical Safety (IPCS) and the Scientific Committee on Food (SCF) of the European Commission. They determined a tolerable daily intake (TDI) for Fumonisins, TCs such as T-2, HT-2, DON, NIV and ZEA, alone or in combination of µg/kg/body weight. (Riazipour et al., 2012) Cereal products are important in our food chain and economy. Therefore, foodstuffs need to be controlled/analyzed during food processing and all mycotoxin analyses for the entire food chain has importance for human health. It is important to continue
to monitor the occurrence of these mycotoxins in cereals and cereal products. The aim of this study was to determine the contamination of wheat grains as one of the important risk factors in Superior territories in Iran.

MATERIALS AND METHODS

Fresh wheat samples harvested from the early May to late September from 7 superior wheat cultivating shores, including the southern provinces (khoozestan), Western (including Kerman shah, Hamedan) and Northern (including Zanjan, Ardebil, Mazandaran, Golestan), for every one hundreds of samples provided, after, drying/adjusting humidity, mixing and re-mixing for each samples were, four samples of 100g were randomly selected in order to sample measurements per 10 tone of origin, sample control, sample stock and the sample was prepared for flour milling process and mixing applying, taken and process were done by the Laboratory stuffs, after comminution. Releasing toxins in solution using solvent extraction, separation were done with the solvent containing 40 ml methanol, 40 ml ethanol and 20 ml acetone up to 20 ml for each 10 g chopped/miled sample transferred to a falcon tube container, previously 20 ml NS and 20 ml of solvent extract to be shaken for 30 minutes then transferred to a water bath to reduce values to 10 ml, till extracts separated using a filter paper Whatman No.1 flat that operating with simultaneous transfer of 10 ml of deionized distilled water to wet the filter and also dilute the extract and speeding the movement take place. Finally 50 micro liters were used for ELISA testing. To detect Fum, Ts, DON, and ZEA levels in the fungal biomasses and the culture medium samples using the Competitive ELISA Procedure as described by R-Bio-Pharm GmbH was used and measured at the absorbance of 450nm (Rosi et al., 2007).

RESULTS

Of wheat samples collected from the North, West and South of Iran, in seven provinces, including 14 cities and shopping centers (Figure 1), according to sampling distribution criterias that is indicateable the number of samples obtained from regions shows, the Northerns belonging a frequency of 71.4 percent, the highest, Westerns by a frequency of 21.4 % finally the lowest are in Southern bring its frequency of 7.1 percent. According to the amount of T toxin measured in grain samples (Mean; 38.436, Range; 19.100 (Min; 27.200, Max; 46.300), Var; 34.229, Std.Dev.; 5.851, Skewness; -0.644, Kurtosis; 0.472) comparing to the amount of Fum. toxin observed in (Mean; 19.151, Range; 6.780 (Min; 16.560, Max; 23.340),Var; 4.306, Std.Dev.; 2.075; Skewness; 0.886, Kurtosis; -0.291) and for Zea. Toxin (Mean; 14.681, Range; 8.700 (Min; 11.140, Max; 19.840),Var; 7.098, Std.Dev.; 2.664; Skewness; 0.758, Kurtosis; -0.508) maintain compliance with the standards and practices conserving National average nutritional values approvals (autorising the mixing wheat for flour making) found that the amount of toxins in wheat have no significant correlation despite reverse relation, but not statistically significant Supporting statistical determination and significant correlations. In examining wheat samples numbers/obtained measurements of toxin shown, normalized distribution frequency of obtained wheat samples for T, Fum, and Zea. toxin, in different ranges concerning the highest T toxin measured zone were at interval ranges of 25-50ppb, Fum (16-24ppb) and Zea (10-20 ppb) because the most number of samples have been accomulate tended the higher range of the curve to the right, a normal curve were resulted. Counter currently a significant degrees of correlation between the numerical differences between the processed wheat T/Fum (NPar-Wilcoxon Signed Ranks Test; Z; -3.296a,
Asymp-Sig.; 0.001, Pearson Correlation; -0.240, Sig;0.408), T/Zea (NPar-Wilcoxon Signed Ranks Test; Z; -3.296a, Asymp-Sig.; 0.001, Pearson Correlation; -0.232, Sig;0.425) and for Fum/Zea (NPar-Wilcoxon Signed Ranks Test; Z; -3.296a, Asymp-Sig.; 0.001, Pearson Correlation; 0.999**, Sig;0.000) toxin values and their disalignment quite reasonable, entirely due to the presence of toxin-producing agents in the process of harvesting, handling, storage, meal preparation and suspetively to take place in the packages and also the increased further. However, the per capita consumption of wheat flour in bread and bread made especially for the cumulative effect of the toxin, that not be negligible.

**DISCUSSION**

In moderate climates, the occurrence of Fusarium and their toxins in cereals is predisposed primarily by wet and cold vegetation periods requisite preventive measures against the multiplication of fungi and toxin production include toring of well-dried grains at optimal conditions. Contamination of feed with a Fusarium toxin can lead to impaired immune functions, metabolism disorders, decreased performance, and increased susceptibility to adverse environmental influences. An inevitable part of the preventive measures is regular food consumption.

![Figure 2](image1.png)

**Figure 2:** histograms of the comparative Fusarium toxin distribution of obtained wheat samples

NPar-Wilcoxon Signed Ranks Test for WT - WZea; Z; -3.296a, Asymp-Sig.; 0.001, Pearson Correlation; -0.232, Sig;0.425
NPar-Wilcoxon Signed Ranks Test for WT - WFum; Z; -3.296a, Asymp-Sig.; 0.001, Pearson Correlation; - 0.240, Sig;0.408
NPar-Wilcoxon Signed Ranks Test for WFum - WZea; Z; -3.296a, Asymp-Sig.; 0.001, Pearson Correlation; 0.999**, Sig; 0.000

![Figure 3](image2.png)

**Figure 3:** histograms of the comparative Fusarium toxin distribution of obtained wheat/flour samples
stuffs monitoring with mycological and mycotoxicological examinations. In 1999, the worldwide contamination of Fusarium mycotoxins (DON, NIV, ZEA, DAS, T-2, HT-2) in cereal grains have been reported by Placinta et al. (Schollenberger et al., 2006). In 2000, mycotoxin contamination (DON, NIV, ZEA) in rice have been suggested by Tanaka et al. (Pleadin et al., 2012). In 2001 the SCOOP (Scientific Co-operation on Questions relating to Food) have been reported data of Fusarium toxins (DON, NIV, FUS-X, T-2, HT-2, DAS, ZEA) in cereals (wheat, corn, barley, oat, rye) collected from 12 countries (The Netherlands, Norway, Portugal, Sweden, UK, Italy, Germany, France, Finland, Denmark, Belgium, Austria) [132]. Between 2003 and 2005, the studies of DON, T-2 toxin, ZEA and FUS (FB1+FB2+FB3) in cereal samples collected from European and Mediterranean markets and Asian-Pacific region have been reported by Binder et al (Karami et al., 2008). The limit values of Fusarium mycotoxins in cereal and cereal products (in the USA, EU and Turkey) are given by (Hazmi et al., 2010, Leslie et al., 2006; Solaras et al., 2009). The International Agency for Research on Cancer (IARC) has evaluated the cancer risk of Fusarium mycotoxins to humans and grouped them as group 2B (probably carcinogenic). Having carcinogenic potential and poisonous effects, mycotoxins are considered to be one of the most important regulatory issues. However, based on available information on the occurrence of Fusarium mycotoxins, FDA accepted that typical Fusarium mycotoxins levels found in corn and corn products intended for human consumption are much lower than the recommended levels. A provisional maximum is fixed for tolerable daily intake (PMTDI) for FB1, B2 and B3 single or in combination of Fusarium mycotoxins were 2 μg/kg of body weight per day on the basis of the NOEL of 0.2 mg/kg of body weight per day and safety factor of 100. In countries with adequate information about mycotoxin occurrence, regular tests to control foodstuffs and detect widespread and serious toxins are currently being performed and this leads to the exclusion of products with higher than allowable limits (Shephard et al., 2000; Tanaka et al., 2007). In 2001 the SCOOP (Scientific Co-operation on Questions relating to Food) have been reported data of Fusarium toxins (DON, NIV, FUS-X, T-2, HT-2, DAS, ZEA) in cereals (wheat, corn, barley, oat, rye) collected from 12 countries (The Netherlands, Norway, Portugal, Sweden, UK, Italy, Germany, France, Finland, Denmark, Belgium, Austria). Between 2003 and 2005, the studies of DON, T-2 toxin, ZEA and fumonisins (FB1+FB2+FB3) in cereal samples collected from European and Mediterranean markets and Asian-Pacific region have been reported by Binder et al. The limit values of Fusarium mycotoxins in cereal and cereal products (in the USA, EU and Turkey) are given by. Unfortunately, a limited number of mycotoxins including Aflatoxins, Fumonisins, Zearalenone and, Ochratoxins are only being measured only in export products, but they are not usually checked in foodstuffs for domestic consumption in Iran. (Egmond et al., 2003, Ghiasian et al., 2006). Contamination of feed with mycotoxins is often a worldwide problem since there is no universal procedure that removes most of the mycotoxins without any effect on the nutritional value or not make it more expensive to produce. With the aim of minor losses in the industry, considerable attention is paid to the prevention of Fusarium mycotoxins contamination, and studies on different types of raw materials and compound feed, depending on various factors, are of great importance. The problem of mycotoxins is particularly expressed during rainy years, when the percentage of mould contamination which leads to subsequent formation of mycotoxins significantly increase. In general, there is a lack of investigations on the presence of mycotoxins in food and feed (Pleadin et al., 2012). In relation to the results of previous researches and also with the published data worldwide, it can be concluded that a certain number of wheat samples in this research had significantly high Fusarium mycotoxins concentrations, also, comparing the obtained concentrations of T toxin, Fum and ZEA with the maximum recommended concentrations for these mycotoxins in feed the results indicated an increased contamination of who feed with Fum, T and ZEA, with mean concentrations of more higher than recommended for food and feed, respectively (Pleadin et al., 2012). A higher Fusarium mycotoxins concentration than the maximum recommended was determined in about 60% of the total number of samples, with a maximum concentration of T (50 ppb), Fum (24 ppb) and Zea (20 ppb) determined in the northern then the other part of the country. In this study it was also observed that the samples in which the low concentrations of ZEA were determined have less fumonisins and predominantly more concentrations of T toxin, or both mycotoxins always could be detected, or mostly the results indicate on both higher concentrations as in our study performed on processed wheat obtained by mixing imported wheat crops. Fusarium toxins side-effects on health are undeniable, due to the chronic and acute effects for consumer is qualified to provide sufficient information about its exposure to the general population. In the past studies, investigated in by ELISA method indicated that all samples were contaminated, also results showed that most samples had contamination higher than of Europe standards but had consonant with Iran national standard, such as amount of higher than standard was not observed surprisingly confirm our results about the original wheat crops and processed wheat flour for bread making. According to the JECFA average of absorption this toxins of all the samples is less than the tolerable daily uptake, reasonably showed that such are recognized dangerous of view and have stringent security to eliminate or reduce this toxin is thought by authorities since not aggregation in occasion the effects of mycotoxins on human health, economic status and sensitivity to the toxin has caused the standard employed for each country is different. Few studies have examined the contamination of fumonisins in cereals.
Khosravi et al., 2013, published data on Mycoflora profiles of fresh and stored rice grains showed that Aspergillus species (37.3%, 40.7%) were the predominant fungal agents, followed by Fusarium (21.6%, 16.2%) as the second agents respectively. In HPLC analysis, most of the rice samples (96.7%) collected were found to be positive, levels varied from one zone to another and throughout. Diverse species of toxigenic fungi, in particular Fusarium species, and high levels in many samples indicate the need for proper surveillance and monitoring exclusively for the prevention of fungi and before it reaches the consumer. Survey of contamination of mycotoxin in cereals and other crops in other countries have led to different results. Alizadeh et al. 2012 reported that Fumonisins B1 (FB1) a toxic and carcinogenic mycotoxin produced in cereals due to fungal infection) contamination of rice and corn samples and its relationship with the rate of esophageal cancer (EC) in a high risk area in northeastern Iran. Geographical subdivisions of Golestan province were measured by thin layer and high pressure liquid chromatographies. The mean level of FB1 and the proportions of FB1 contaminated samples were compared between low and high EC-risk areas of the province. The mean of FB1 levels in corn and rice samples were 223.64 and 21.59 μg/g, respectively. FB1 contamination was found in 50% and 40.9% of corn and rice samples, respectively even found high levels of correlations between FB1 contamination in rice and the risk of EC. Therefore, fumonisin contamination in commonly used staple foods, especially rice, may be considered as a potential risk factor for EC in this high risk region. Daily intake of Fusarium toxins are considered hazardous and should be stringent those results suggesting that the type of bread and flour in terms of contamination, showed no significant differences and were accounted the lowest and the highest contamination levels of the toxin. Attention to this subject that wheat is one of the most widely used food substances in cereal series, over prevalence contamination in wheat samples of various aspects can be considerable seriously. In case of contamination with levels above the limit of the cycle is eating out. (Sadeghi et al., 2014). The occurrence of mycotoxins produced by Fusarium spp. in small cereal grains, particularly in wheat, is of great concern worldwide, because their presence in processed foods and feeds seems unavoidable. Consequently, they have been associated with chronic or acute mycotoxicoses in a lesser extent, in humans. Our results are in agreement with other studies in the USA, Canada, Argentina and Europe. (Cherhi et al., 2010). Although the distribution of Fusarium toxins concentration in the ranges considered, are not significantly correlated are countercurrent (Figure 3). But it should be noted that most concentrations were in the range of which may indicate endemic fungal causative agents of fusarium toxins in the conducted geographical areas (Figure 3).

Given that the largest amount of toxin production observed in the range of ppb, therefore, this suggests the possibility of Fusarium infection in all studied wheat fields or ware houses for temporary maintenance or transportation process (Figure 3 and Table 1). The highest possible average toxin production due to the plurality of samples collected from the area north and south and then to the West of country (Figure 1 and 2). Based on the results of samples collected there are no significant differences, although pollution levels above the limit. According to the results of this research can be said that of all the major steel-producing Fusarium toxin, is at intervals after planting and cultivation remains, and in the longer term remains and can cause contamination of farm and food products there for years. This level of contamination varies according to geographical regions, but in the process of harvesting wheat, transport and storing contamination by toxins toxin may be somewhat reduced and sometimes increased. Comparing the results of studies in other countries, it can be concluded that the major items of potential contamination of food due to fungi and toxins exist and should be harvested at all items. Human nutrition ingredients, apply to the use of international standards and conditions for shipping they keep creating. Another interesting point is that the harvest at the end of the line Production or the food to be less time consuming, less chance of infection.

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REFERENCES


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