

According to consumer research studies, top food trends for 2019-2020 include consumer demand for healthy grains, food safety and transparency (RSM, 2019; CBINSIGHTS, 2019). As a leading food ingredient supplier, Healthy Food Ingredients (HFI) is committed to supplying healthy, safe ingredients to customers.

Food safety incidents in the U.S. account for an estimated \$7 billion to the food industry which includes notifying consumers, recalls, monetary damages and lawsuits (Hussain & Dawson, 2013). This economic burden is further worsened by the estimated annual 128,000 hospitalizations and 3,000 deaths in the U.S. which are related to food-borne illnesses (CDC, 2018). This highlights the need for an increased focus on microbiological safety for foods that are produced for domestic and overseas markets in order to avoid unexpected food safety outbreaks. Furthermore, the Food Safety Modernization Act (FSMA) requires that manufacturers be proactive rather than reactive to food safety risks (FDA, 2018).

Recently, healthy grains have gained more attention from consumers worldwide. These grains boast beneficial nutrients such as antioxidants, dietary fiber, proteins, lignans, omega acids and many other bioactive compounds (Goyal et al., 2014). Based on intended use or application by consumers and manufacturers, these grains could be utilized in a raw or uncooked form, such as in cold cereals, yogurts, beverages, pressed bars and toppings (HFI, 2018a). While low moisture foods could be assumed as safe for

consumption in raw form, recent outbreaks of Salmonella and E. coli O157:H7 suggest otherwise. Grains and beans accounted for 2.9% of total Salmonella illnesses and 0.7% of E. coli O157:H7 illnesses from 1998-2008 (Painter et al., 2013). Apart from these past incidents reported by the Food and Drug Administration and Center for Disease Control, a recent market study conducted on 31 retail flax and chia products by an independent third party research group shows several of these products contain APC and Coliform values higher than the acceptable levels (HFI, 2019). Some recorded values were well above the Canadian, Australian and National Advisory Committee on Microbiological Criteria for Foods' guidelines on ready-to-eat (RTE) food (NSW Food Authority, 2009; Health Canada, 2010; USDA, 2014).

The risk of pathogen contamination in raw, low moisture foods may be increased by unsafe practices during cultivation, processing and packaging (Shah, 2016; Podolack et al., 2010). In one method of pasteurization, dry heat is used to reduce pathogens in raw, low moisture food, where high temperature is used over a longer period of time (Beuchat & Mann 2011). This method has been shown to have a negative impact on the chemical, physical and nutritional quality of ingredients (Shah, 2016). Vacuum pasteurization has been identified by researchers as an alternate, yet effective method to reduce pathogens in raw, low moisture food while maintaining product integrity.

A study conducted by HFI revealed that its IntegriPure® vacuum pasteurization technology which utilizes steam under controlled pressure to form dry, saturated steam can reduce pathogens for a 5-log reduction without affecting the physiochemical and functional properties of flax flour (HFI, 2018b). HFI's IntegriPure micro-reduction process is an ideal method to mitigate food safety risk of ingredients due to its rapid, high heat transfer coefficient. Gentle rotation of the IntegriPure system assures even heat treatment. Other heat treatment methods can lead to issues including moisture changes, color changes and product clumping. Efficacy of the vacuum

pasteurization has been evaluated by Shah (2016) in which the findings further validate HFI's internal results for microbial reduction and final product quality of the IntegriPure system.

Food safety cannot be compromised as it can jeopardize consumers' lives and business. Under FSMA regulations manufacturers are responsible for implementing supply chain programs to mitigate risk (FDA, 2018). HFI's IntegriPure brand means industry-leading validation for a 5-log reduction providing food safety assurance, naturally, to protect your brand promise.

References

- Beuchat, L.R. & Mann, D.A. (2011). Inactivation of Salmonella on Pecan Nutmeats by Hot Air Treatment and Oil Roasting. *Journal of Food Protection*, 74, 1441-1450.
- CBINSIGHTS. (2019). Food and beverage trends. Retrieved from <https://www.cbinsights.com/research/food-beverage-trends-2019/>. (Accessed on Oct 31, 2019).
- CDC. (2018). Estimates of Foodborne Illness in the United States. Retrieved from <https://www.cdc.gov/foodborneburden/index.html>. (Accessed on Nov 1, 2019).
- FDA. (2018). FSMA Final rule for preventive controls for human food. Retrieved from <https://www.fda.gov/food/food-safety-modernization-act-fsma/fsma-final-rule-preventive-controls-human-food>. (Accessed on Nov 1, 2019).
- Goyal, A., Sharma, V., Upadhyay, N., Gill, S., & Sihag, M. (2014). Flax and flaxseed oil: an ancient medicine & modern functional food. *Journal of food science and technology*, 51(9), 1633-1653.
- Health Canada. (2010). Retrieved from http://publications.gc.ca/collections/collection_2014/sc-hc/H164-167-2013-eng.pdf. (Accessed on Nov 1, 2019).
- Healthy Food Ingredients. (2018a). Micro reduction process. Fargo, ND, USA.
- Healthy Food Ingredients. (2018b). Effect of vacuum pasteurization on physiochemical and functional properties of flax seed flour. Fargo, ND, USA.
- Healthy Food Ingredients. (2019). Internal test results. Fargo, ND, USA.
- Hussain, M., & Dawson, C. (2013). Economic impact of food safety outbreaks on food businesses. *Foods*, 2(4), 585-589.
- NSW Food Authority. (2009). Microbiological quality guide for ready-to-eat foods. Retrieved from http://www.foodauthority.nsw.gov.au/_Documents/scienceand-technical/microbiological_quality_guide_for_RTE_food.pdf. (Accessed on Nov 1, 2019).
- Painter, J.A., Hoekstra, R.M., Ayers, T., Tauxe, R.V., Braden, C.R., Angulo, F.J., & Griffin, P.M. (2013). Attribution of foodborne illnesses, hospitalizations, and deaths to food commodities by using outbreak data, United States, 1998-2008. *Emerging Infectious Diseases*, 19, 407-415.
- Podolak, R., Enache, E., Stone, W., Black, D.G., & Elliott, P.H. (2010). Sources and risk factors for contamination, survival, persistence, and heat resistance of Salmonella in low-moisture foods. *Journal of Food Protection*, 73, 1919-1936.
- RSMUS. (2019). Top trends for food and beverage industry. Retrieved from <https://rsmus.com/what-we-do/industries/consumer-products/food-and-beverage/top-trends-for-food-and-beverage-industry-businesses.html>. (Accessed on Nov 1, 2019).
- Shah, M. K. (2016). Assessment of Vacuum Steam Pasteurization to Improve Safety and Quality of Low Moisture Foods. *PhD dissertation*. North Dakota State University, Fargo, ND, USA.
- USDA - Food Safety and Inspection Service (2014). National Advisory Committee on Microbiological Criteria for Foods. Retrieved from <https://www.fsis.usda.gov/wps/wcm/connect/7fb1a71f-27fa-4b04-a065-82f65e21cb03/NACMCF-Process-Control-111714.pdf?MOD=AJPERES>. (Accessed on Jan 26, 2020).

HFI third-party lab test results conducted from samples of consumer-ready retail brands on store shelves in the marketplace.

TEST RESULTS

Aerobic Plate Count Coliforms /g
/g AOAC 966.23 - AOAC 991.14 -
UMVEP UMDBM

PRODUCT	BRAND	ORG/CONV	APC	Coliforms	uom
Flaxseed - Ground	C	Organic	360,000 (est)	<10	cfu/g
Flaxseed - Ground	D	Conventional	290,000	<10	cfu/g
Flaxseed - Ground	D	Organic	390,000 (est)	<10	cfu/g
Flaxseed - Ground	D	Organic	830,000 (est)	<10	cfu/g
Flaxseed - Ground	E	Organic	>5,700,000 (est)	<10	cfu/g
Flaxseed - Ground	P	Organic	140,000	1,400	cfu/g
Flaxseed - Whole	A	Organic	910,000	<10	cfu/g
Flaxseed - Whole	C	Organic	270,000	<10	cfu/g
Flaxseed - Whole	D	Organic	160,000	3,400	cfu/g
Flaxseed - Whole	D	Conventional	480,000 (est)	<10	cfu/g
Flaxseed - Whole	H	Conventional	240,000	<10	cfu/g
Flaxseed - Whole	P	Organic	470,000 (est)	<10	cfu/g

Results noted in red reflect values reported well above the Canadian and Australian guidelines and National Advisory Committee on Microbiological Criteria for Foods' guidelines on ready-to-eat (RTE) food (NSW Food Authority, 2009; Health Canada, 2010; USDA, 2014).